

SCIENCE

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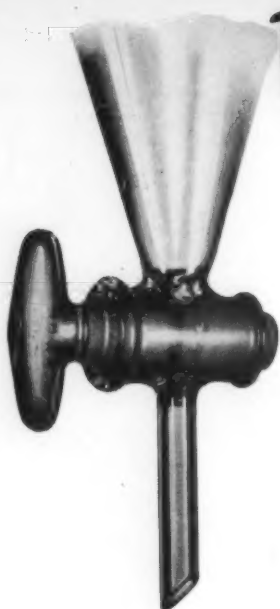
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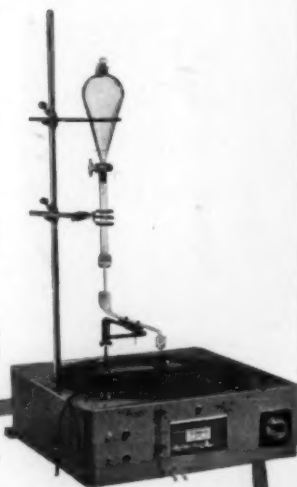
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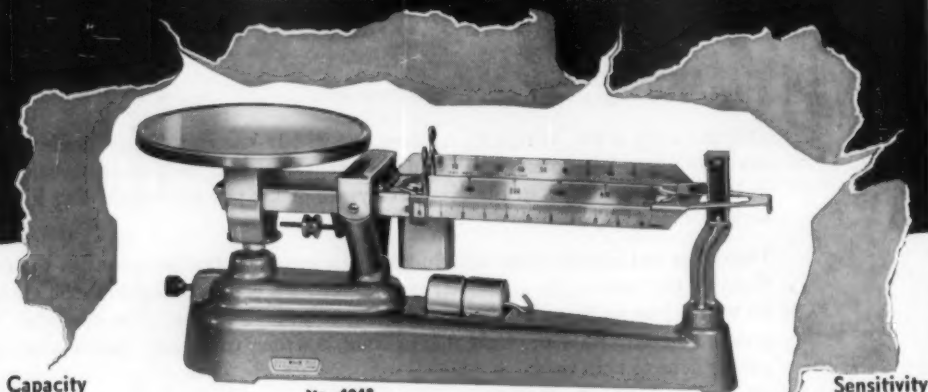
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Science and the State Department

THE report *Science and Foreign Relations*, prepared by Lloyd V. Berkner, special consultant to the Secretary, examined the twofold question of how the department could aid in the progress of science and reflect the effects and potentialities of this progress in the conduct of its foreign relations. The report also made certain recommendations to enable the department effectively to meet its responsibilities in the scientific aspects of foreign relations. They included proposals (a) for establishment in the department of an Office of Science Adviser, to be primarily responsible for advising on the science aspects of U. S. foreign policy and programs; and (b) for establishment in important diplomatic missions of science attaché posts to aid the office in carrying out its responsibilities.

The Office of the Science Adviser was formally established February 6 under the direction of the Under Secretary of State. A beginning has thus been made for setting up a mechanism which, in cooperation with the National Research Council, can bring American scientists into closer relation with government and, at the same time, be helpful in the progress of science. The office will be guided by the principle of an optimum international flow of scientific information and exchange of scientific persons, consistent with considerations of national security.

The office will heed the report's proposal of "a foreign policy that will permit the fullest possible exchange of unclassified scientific and technical data." It will be "scrupulous in adhering to the established rules and standards of national security," but at the same time "be constantly on its guard against the abuse of these rules and standards."

The office is mindful of the report's observation that interchange of scientists constitutes "a means for accelerating scientific creative thinking," and will attempt to carry out the recommendation that "the De-

partment . . . lend strong support to recognized international professional scientific organizations and meetings through a positive program directed toward adequate support of United States delegates to such meetings." On the matter of bringing into this country foreign scientists for temporary professional visits, the office will urge the department to "weigh the potential contribution to United States scientific progress and to international understanding represented by such visits against the potential hazard to this country of admitting such scientists."

American scientists can help the Office of the Science Adviser perform its responsibilities in several ways. Suggestions or proposals on science and foreign policy will be welcomed. Constructive contributions for a more effective international understanding through science will be most helpful. Background and other available details will help bring satisfactory results when scientists direct attention of the office to particular problems of international exchange of scientific information or persons.

Preparation for international travel connected with scientific lecture tours, symposia, international organization meetings, etc., is important and requires co-ordination of public and private endeavors for plans to work out smoothly. Accordingly, the office will be more effective in facilitating travel and other arrangements for these purposes if scientists will furnish it or NRC in advance with the fullest information at hand about their plans.

Science attachés can be especially helpful to American scientists in foreign countries in facilitating their arrangements. To help ensure effective assistance from our science attachés, scientists planning travel abroad are urged to notify the office or the NRC of their travel plans.

Cooperation between American scientists and the Office of the Science Adviser is basic to the success of the science program.

J. B. KOEPFLI

Office of the Science Adviser
Department of State

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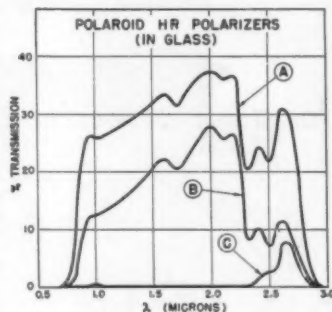
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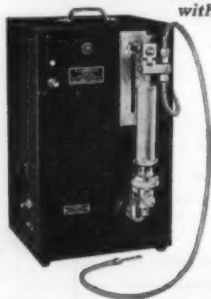


(A) Single filter
(B) Two filters, polarizing axes parallel
(C) Two filters, polarizing axes crossed



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The Australian National University¹

Sir Douglas Copland²

Australian National University, Canberra

THE AUSTRALIAN NATIONAL UNIVERSITY was established by Act of the Commonwealth Parliament in 1946, with the object of encouraging fundamental research and the training of research workers. Although it may eventually incorporate the Canberra University College and thus enter the field of undergraduate teaching, it is primarily intended as a postgraduate institution. Its emphasis on research and the training of graduate students makes it unique in the Australian academic structure and will enable it to supplement the work of the other universities at a higher level. So far, four research schools have been established: the John Curtin School of Medical Research, the Research School of Physical Sciences, the Research School of Social Sciences, and the Research School of Pacific Studies.

The establishment of a new university involves a period of building, both building in a literal sense and the moulding of an administrative and academic organization able to carry out the functions of the university. On both scores good progress has been made.

So far as bricks and mortar are concerned, the university's building program has necessarily been shaped by the housing shortage and the difficulties of undertaking large-scale construction during a period of nation-wide development. The activities of the university were thus directed primarily toward the construction of buildings that would provide accommodation for its staff. The first major building started was University House, which will be the university's residential college and the center of social and cultural activities. University House should be completed in time for occupation early in 1952. In addition, six houses are being built on the university site, and others are nearing completion, are already occupied in various parts of Canberra, or have been purchased in the open market. Altogether a hundred dwellings will be needed before the end of 1951.

So far as academic buildings are concerned, the university is fortunate in having on its site the old hospital buildings, which have been used as government offices and libraries since the erection of Canberra's new hospital. Some of these have already been made available to the university, and the library began to function as a self-contained unit, with 50,000 volumes already purchased, early in January. Some depart-

ments, notably International Relations, Law, and Economics, are already functioning in these buildings, and, when they are all handed over to the university, they should provide sufficient temporary accommodation to house, besides the library, the whole of the Research Schools of Social Sciences and Pacific Studies.

M. L. Oliphant is supervising the erection of the buildings for the Research School of Physical Sciences which, with University House, are the only major buildings so far begun. These should be completed in time for Professor Oliphant to begin operations some time during 1951. Plans for the Medical School have been completed, and building of the workshops will soon be undertaken. A start will be made on the research laboratories toward the end of the year, but no other buildings will be constructed until conditions in the building trade are easier. The university's administrative headquarters are housed, for the time being, in converted army huts on the site.

By the end of 1951, therefore, the university should be taking physical shape. This does not mean, however, that it will not function as a university until then. Three departments of the Social Sciences are already operating in Canberra, two medical departments are engaged in research in Melbourne, one in London, and one in Dunedin. Altogether 21 members of the academic staff have been appointed, including Professor Oliphant, director of the School of Physical Sciences, 12 professors, 5 readers, and 3 research fellows. In addition, there are 11 people undertaking research on University Research Fellowships, and 53 reading for higher degrees in overseas universities on National University Scholarships. The administrative and library staff numbers 69. During 1950, 50 people joined the university's staff. During 1951 the number of new appointments is expected to reach 80, and by then most appointments for the existing organization should be filled.

The other principal activity of the university during this preliminary period has been to invite distinguished overseas scholars to Australia to confer with Australian research workers and to conduct lectures and seminars in Australian universities. As the university's own activities expand, this aspect will become less important, but it has been a means of bringing Australian institutions into touch with the leaders of overseas thought, and has achieved a subsidiary aim of introducing the National University to the academic world. As part of the Commonwealth Jubilee celebra-

¹ Based on an address to the Council of Adult Education Summer School at Albury, January 3, 1951.

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tions in 1951, two Jubilee Seminars have been arranged on the topics "Scientific Research and the Commonwealth" and "Federalism." For the first Sir Edward Mellanby, of the United Kingdom Research Council, and James Conant, of Harvard, have been invited; the second will be conducted by K. C. Wheare (Oxford), W. A. Mackintosh (Queen's University, Ontario), and J. L. Montrose (Belfast).

In the next year the university will undertake more of the academic functions that are normally attributed to a university. So far the work has been necessarily concentrated on research, but the second important aspect of the university's activities, the training of graduate scholars in methods of research, will be started in 1951 with the admission of a limited number of students who will read for Ph.D. degrees.

In other respects, also, the organization of the university will be taking a more familiar shape. The present Interim Council should shortly be replaced by a permanent governing body, elected partly by convocation. In other universities the electoral body consists of the university's own graduates, but because the National University as yet has no graduates, arrangements have been made for convocation to consist of members of the Interim Council, certain members of the staff, and representatives of other Australian universities. Pending the arrival of the full academic staff in Canberra, academic problems have been referred to an Academic Advisory Committee in Britain, comprised of Professor Oliphant as director of the Physics School; two other distinguished Australians, Sir Howard Florey and K. C. Wheare, advising on the Medical School and Social Sciences School, respectively; and the eminent New Zealand anthropologist Raymond Firth, advising on the Pacific Studies School. This body is continuing to function, and advantage will be taken of Professor Wheare's seminar visit, and the fact that Professor Firth will shortly be working at the National University for a period of one year, to hold a meeting in Australia during the middle of 1951 to discuss the general development of the university. Meanwhile, the continuing academic body, the Board of Graduate Studies, has commenced to operate in Canberra.

The familiar university routine will begin this year, following the enactment of a statute fixing university terms, providing for the admission of students, etc. It is planned that each professor will be in charge of one of a number of departments under the general supervision of a director. The School of Social Sciences, for example, will for the time being consist of the Departments of Economics, Law, Political Science, History, and Social Philosophy. Each professor will have under him readers and perhaps some permanent fellows, but most of his staff will be comprised of research fellows, whose appointments will be of limited tenure. The latter will perform a vital function in the university—in addition to pursuing their own research, they will help train the graduate scholars and, after a few years, will be expected to

move on either to higher positions within the university or to other universities and learned institutions. In this way there will be a constant stimulus arising from new blood on the staff.

The professor will be responsible for framing the general research program within his own department and will cooperate in the research work of the school as a whole. He, with other members of the staff, will be engaged primarily in research, but, because it is recognized that research needs supplementing by teaching and discussion, these activities will become an integral part of his work. His teaching will mainly take the form of the training of graduate scholars, but he will be encouraged to get about and accept, by invitation, limited teaching obligations in other universities and other institutions. The work that senior staff members will be required to undertake is of such importance that appointees must be scholars of international reputation. To draw such people, the terms of appointment have deliberately been made attractive—salaries are relatively high; plenty of time will be made available for individual research, and adequate assistance will be granted in the form of research assistants, library facilities, and up-to-date equipment; and there will be liberal provision for travel and leave.

The typical student will be a graduate of another university—not just an ordinary graduate, but an honors graduate especially selected as someone able to hold a place in the Australian academic scene. He will live at University House and read for a Ph.D. degree, meanwhile undertaking research of his own and helping with the research of others under the supervision of a senior member of the staff. The usual relationship of a small staff and a large number of students will be reversed, so that there will be a relatively small number of students compared with staff. By the time he has received his doctorate the student should be well qualified to take a post on the staff of another university, or to accept a research position with government or industry.

Finally, it should be mentioned that not all the students will be Australians. It is hoped that the university will soon build up a reputation that will attract scholars from all over the world. It should be able to do this, partly because it will occupy a special position in one of the world's academically unmapped areas—southeast Asia—and partly because it will endeavor to provide for some of the needs of southeast Asian students themselves.

These few comments should be sufficient to show that, while the National University is rightly described as an experiment in education, it is an experiment that holds great promise for the future of Australian university education. Other countries have developed graduate universities, and the National University is not the first institution to place primary emphasis on research. But the Australian National University is perhaps the first to combine these two functions and make them the predominant reasons for its existence.

Technical Papers

A Purification of the Active Principle of Short Ragweed Pollen

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Extracts of ragweed pollen as used today for the diagnosis and treatment of ragweed-sensitive patients are generally buffered aqueous solutions, to which has been added glycerine or glucose as a stabilizing agent. These extracts contain the active principle which causes the symptoms of hay fever and asthma in the sensitive individual and when tested on the skin of such a person will cause a reaction of the immediate whealing type. It has been known for some time that the active principle is composed of several antigenic fractions; the presence of 3 to 5 has been observed by several investigators, using electrophoretic (1), skin testing (2), or modified precipitation techniques (3). These solutions are also highly pigmented, containing flavanols (4) and possibly other substances, which act as irritants and unnecessary diluents of the active principle. The presence of irritants in food and dust extracts is an important cause of the false positive reactions that are commonly produced when testing for sensitivity to these substances.

We have been successful in removing the pigments and possibly some other irritating substances, by means of a simple adsorptive process, without weakening or denaturing the active material, as determined by skin tests upon ragweed-sensitive persons. The whole short ragweed pollen (*Ambrosia elatior*) was dried to constant weight, and the ether-soluble lipids removed by Soxhlet extraction. Then 18.1050 g of dried, defatted pollen was extracted with 425 ml water at 5° C for 18 hr. The suspension was filtered, and the filtrate made up to 500 ml in a volumetric flask. Aliquots were lyophilized to determine solid content, which amounted to 4.8280 g of golden-brown material in the total extract. Kjeldahl analysis showed 3.26% nitrogen.

An adsorption column of 20 g of acid-washed alumina, slurried in 50 ml of water (pH 5-6), was prepared, and 50 ml of the water extract was chromatographed. The coloring material was strongly adsorbed in a single yellow band at the top of the column. The column was washed with 150 ml of distilled water. Colorless material, amounting to about 60% of the weight of the solids in the chromatographed extract, passed directly through the column. A series of fractions was collected. Each fraction was lyophilized for weight of solids and analyzed for nitrogen content, with the results shown in Table 1.

TABLE 1

CHROMATOGRAPH OF 50 ML OF YELLOW AQUEOUS EXTRACT (pH 5.5) CONTAINING 0.4828 g (9.66 mg/ml)

Fractions	Vol	Wt	Mg/ml	% Nitrogen	pH of solution
1	50 ml	59.0 mg	1.18	—	6.1
2	15	50.1	3.33	2.28	5.85
3	15	64.8	4.33	2.17	5.91
4	15	76.0	5.06	2.07	5.93
5	15	45.6	3.04	2.21	5.55
6	15	19.4	1.29	3.10	5.40
7	15	11.2	0.75	4.28	5.30
8	15	7.3	.49	2.79	5.30
9	17	6.0	.35	2.78	5.30
10	15	3.4	.23	—	5.15
11	16	3.8	0.23	—	5.16

Final washing of all the liquid off the column yielded a negligible amount of material. This procedure has been repeated on other batches of pollen with almost identical results.

All the fractions were white, hygroscopic solids, completely soluble in water. All reacted positively to the Molisch test for carbohydrate. The Benedict's test was positive only after hydrolysis. The starch-iodine test was negative, and all fractions except the first gave a positive biuret test.

The activity of these colorless fractions in causing skin reactions was observed in 10 ragweed-sensitive subjects by doing serial scratch tests, in which varying dilutions of the fractions in an aqueous phenol-dextrose solution (5.0% dextrose, 0.5% phenol) were used. The resulting skin reactions were compared with those produced by similar nitrogen dilutions of

TABLE 2

Dilutions (mg N/ml)	Original extract	2	3	4	5	6	7
<i>Subject B. G.</i>							
0.15	+++	++	+++	+++	—	—	—
.05	++	++	+++	+	—	—	—
.017	+	+	+++	+	—	—	—
.0056	±	+	++	+	—	—	—
0.0019	±	+	+	±	—	—	—
<i>Subject J. B.</i>							
0.15	++++	++++	++++	++++	++++	—	++
.05	+++	+++	++++	+++	+++	—	++
.017	++	++	+++	++	++	—	++
.0056	+	++	++	+	++	—	+
0.0019	±	+	+	±	+	—	0

++++ reaction = wheal larger than 1 cm in diam.
+++ and ++ reactions = reactions intermediate between ++++ and +.
+ reaction = clearly defined wheal, with erythema.
± reaction = questionable, not considered positive.
— = not tested.

the original unchromatographed extract. Not all the subjects were tested with all the fractions. Results of 2 typical cases are given in Table 2.

The nitrogen content of the weakest dilution causing a reaction in each subject was determined for each fraction and the original extract. It was seen that in many instances some fractions gave reactions when the unchromatographed extract containing an equal or larger amount of nitrogen did not. This was especially true of Fractions 2, 3, and 4.

We are at present subjecting this material to more extended chemical investigation, electrophoresis, and other immunological studies. We also intend to place a group of ragweed patients upon treatment with it, observing the clinical results, its absorption, and incidence of reactions, as compared with ordinary ragweed extracts. We are extending this work to food, dust, mold, and other allergens. By decreasing the incidence of false positive reactions and by increasing the potency of our testing materials, it is felt that the reliability of skin testing in the diagnosis of allergy will be tremendously increased.

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The Mg Content of Various Nucleic Acid Compounds

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Since they can readily be disaggregated by minimal quantities of salts (1, 2), a number of polynucleotide bonds can be assumed to be essentially of electrovalent type. In experiments made to determine whether metals were active in this connection, it was found that Mg was present in a relatively high concentration. On the other hand, closely related metals such as Ca and Zn were not present to any marked extent. Traces of Sn and Pb were found, but these metals appeared to be loosely bound and were presumably impurities.

The Mg content varied within fairly narrow limits, and an order of magnitude, that was to some extent characteristic, was found within each group of substances studied. There appears to be some correlation with the degree of polymerization, although the Mg content seems to be more dependent on the mildness of the preparative procedure used. The Mg content can be decreased by dialysis. This is presumably caused by hydrolysis, and this is facilitated by other salts that expel Mg. On longer treatment—for example, with strong NaCl solutions—the Mg content decreases appreciably, but is only freed altogether after treatment with acid. It is therefore understand-

TABLE 1

Material	Preparation according to	Mg content Spectroscopically estimated order of magnitude (%)
Sodium thymonucleate from calf thymus	Hammarsten (1924)	0.01-0.1
	Hammarsten (1924)	~ 0.1
	Gulland <i>et al.</i> (1947)	~ 0.1
	Gulland <i>et al.</i> (1947)	~ 0.1
Nucleohistone from calf thymus	Carter and Hall (1940)	0.1-1
	Carter and Hall (1940)	0.1-1
	Carter and Hall (1940)	~ 1
Thymus from calf	(Lipid-freed by treatment with alcohol-acetone)	0.1-1
Ribose nucleic acid from yeast	Johnson and Harkins (1929)	~ 1
	Levene and La Forge (1910)	> 1
(Commercial preparations)	Merek	~ 1
	May and Baker	~ 0.1
	Lemke	~ 0.1

able that preparations exposed to stronger reagents do not show the same high concentration of Mg.

Table 1 shows a survey of the results of spectroscopical studies (for which the writer wishes to thank S. Landergrén, of the Geological Survey of Sweden).

Chemical analysis offers considerable difficulty because of the large amount of disturbing alkaline phosphates after combustion. We have tried wet and dry combustion, followed by precipitation as $Mg(NH_4)PO_4$ or $MgCO_3$, but with poor reproducibility. By spot tests (Titian yellow and others) after mild acid hydrolysis, Mg is easily detectable.

The Mg content of sodium thymonucleate is of interest in view of the Mg activation of desoxyribonuclease, but also for other enzymes with a possibly analogous mechanism. As have similar ions (i.e., Ca^{++}), Mg^{++} has evidenced certain special effects on sodium thymonucleate in the way of gelation, hydrolysis, etc., as found by Hammarsten (3). An aggregate weight many times higher than normal is found on precipitation of sodium thymonucleate in the presence of Mg^{++} with ethanol (4).

No such distinct effects of divalent ions are found in the case of polyribose nucleotide from yeast in which Mg (5), as well as Cu and Ca, (6) has been found. Many signs of the importance of Mg in processes possibly connected with the metabolism of nucleic acid have, however, been observed (e.g., works by Fulmer *et al.* [7]).

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Sound Recording and the Problem of Evidence in Psychiatry¹

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Recording the verbal behavior of patients. Research workers in the field of psychodynamics have long been in the paradoxical situation of having their most productive source of data, the psychiatric interview, closed to the scrutiny of independent observers. Much of the research and instruction in the field of psychotherapy has thus depended on hearsay. In order to subject the patient-therapist relationship and the verbal and other behavior involved therein to study, psychotherapists have resorted to note-taking. Freud (1), who noted that the presence of a third party may distort to a significant degree the productions and behavior of patient and physician, made his records retrospectively at the end of a working day. Some workers have followed this lead. Others take occasional notes during the course of an interview, recording a key word or phrase and using it later as a stimulus for further elaboration. Such elaboration generally takes place a long time after the original notes were jotted down. Still others take profuse "verbatim" notes throughout each session.

These methods are subject to a number of criticisms. They depend on the author's memory, and the records may contain significant omissions and distortions. Kubie (2) draws attention to the impossibility of retaining by unaided memory an adequate record of the course of treatment. Even the most proficient note-taker misses critical material, and attention to the note-taking process inevitably detracts from attention to the interview situation itself and from the aim of the interview, diagnostic or therapeutic. This not only contributes to omissions, but is one source of actual distortion of data, inasmuch as the behavior and attention of the psychiatrist influence the productions of the patient.

Not so obvious, but perhaps more important in the recording of psychiatric interview data, is the influence of conscious and unconscious screening in the therapist himself. The incoming sensory material often is neither adequately nor completely recorded. The

authors found by comparing memories, notes, and actual transcriptions that important material often was omitted. At times recorded interviews elicited responses of startle and surprise, as though the therapist had not previously been in the actual situation and had not previously heard the patient's and his own verbal productions. Omissions, distortions, elaborations, condensations, and other modifications of the data occur, and these all contribute to the difficulty of evaluating what really happened. These processes are important from the viewpoint of methodology and are being studied further.

Recording the verbal behavior of therapists. Observations of the patient and his productions constitute but one part of the significant data of an interview. Another part should consist of observations of the therapist, how he responds to the patient, and how his behavior provokes activity on the part of the patient. Theoretically, the fully trained and experienced psychotherapist should constantly be able to evaluate his own as well as the patient's psychological status during the course of the interview. This cannot, however, be scientifically confirmed unless another observer can somehow be introduced into the situation. This observer cannot, of course, be directly aware of the un verbalized or unconscious thoughts and feelings of the therapist, but on the basis of observed behavior, augmented by accounts of the therapist's own ideations and rationale of treatment, inferences should be possible (3). It should be kept in mind that changes of the interviewer's status from participant to observer alter the context of the interview (4).

Sound recording as an observational method. As verbal behavior is of paramount importance in psychotherapy, sound recordings permit adequate reproduction of the main features of the process. The method was initially used by Zinn (5), F. Deutsch (7), Bierer (8), and more extensively by Rogers (9) and his students. Recently the technique has been perfected to such high standards of fidelity that it has become possible to realize its full potentialities. Minor inflections and nuances, and details of verbal interplay that were formerly missed are now picked up. Unobtrusive though not concealed sound recordings may be obtained in a fashion that need not disturb therapist or patient. Listener strain is reduced to a minimum, and reproduction is of auditorium or broadcast quality (10). The data, preserved on tape, may be listened to and analyzed carefully, with opportunity for relistening, by more than one observer. Through the use of recordings the "iron curtain" of the psychotherapist's office, which has so far blocked independent critical inspection, can be lifted.

Direct observation of interviews. As indicated above, inferences about the participants in an interview are based on visual as well as auditory cues. This is one reason why it is important that observers who listen to recordings of interviews be themselves experienced in interviewing. The experienced therapist will not overevaluate auditory cues and underestimate the im-

¹ This work is aided by a grant from the Veterans Administration, VAm23379B.

portance of nonauditory cues. A blank pause on a tape record may represent a smile or sympathetic gesture by the therapist, the silent weeping of the patient, or innumerable other behavioral possibilities. Unless, as Kubie (5) recommends, a movie of the interview is taken, the visual impressions cannot be recorded for exact reproduction. So far, however, the technical difficulties in unobtrusively making sound movies of the psychotherapeutic process have not been overcome. For more fleeting impressions, one-way mirror observation is being widely used. This allows simultaneous direct observation by a number of observers, whose independently arrived at formulations may then be compared.

Inferences and primary data. There have been only a few studies (13-16) dealing with the problem of evidence in psychoanalytic propositions. From these it is apparent that detailed specific and concrete reports of the original data and the psychological and logical processes leading to inferences regarding such material are extremely rare. Actually, perusal of the psychiatric and psychoanalytic literature indicates that in a number of instances inferences by the therapist are treated as if they were primary data. Recognition of the unique features of the psychotherapeutic interview as a data-gathering situation does not, however, imply the theoretical inapplicability of the usual scientific criteria for evidence, or obviate the ultimate necessity for critical evaluation of data by independent observers. There are, of course, tremendous practical difficulties involved, and sound recording offers only the most elementary approach to many of these, especially to problems related to the identification of unconscious or partially conscious, un verbalized factors in the therapist and their influence upon, and interaction with, similar phenomena in the patient.

The recognition of limitations is not, however, a valid argument against the employment of new methods. Recordings permit study of the therapist's interpretations to patients and of his inferences made for the benefit of scientific colleagues. This medium will help to introduce a more rigorous operational approach, differentiating primary data, deductions, and inductions. As data become accessible to multiple observers, problems of agreement, reliability, validity, probability, and prediction may be studied. The differentiation between basic principles—if such exist—and individual practices based on common or uncommon sense and intuition is one of the important problems that may be studied with this method. Studies of the dynamics of the therapeutic process, variables in patients and therapists, and the evaluation of the total therapy should be within the realm of an objective approach.

Recordings may also be used in the evaluation of experimental organic therapies. The Yale Lobotomy Project is currently employing this technique in evaluating the dynamics of the interview situation with patients before and after prefrontal lobotomy.

One last word of caution should be added: The sys-

tematic analysis of sound recordings is an extremely time-consuming procedure. The procedure itself is at times uncertain and unsystematic unless a rather specific project is pursued and specific questions are asked. Such lack of system is one of the consequences of the absence of a universally accepted and satisfactory theory of behavior—notwithstanding some important beginnings in the creation of a science of behavior, such as the attempt to fuse concepts of psychoanalysis and learning theory (11) and H. A. Murray's approach (12). Improvement of procedure will lead to better theory, which in turn will permit a more systematic method in the complex science of normal and abnormal human behavior.

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Some Effects of High Velocity Electrons on Wood

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It has been shown by others that ionizing radiation of suitable intensity will produce chemical changes in materials subjected to such radiations (1-3). The modification of a 1-mev pressure insulated resonance transformer-type x-ray unit (4) provided a source of high velocity electrons with which a dose was accumulated at the rate of approximately 0.14×10^6 equiv r/sec. Much higher doses are readily realized with this source than with the usual x-ray and radioactive sources.

Irradiation of basswood with high velocity electrons alters its structure in such a way that some of the

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insoluble carbohydrate components become available to rumen bacteria. The production of volatile acids from the incubation of irradiated wood samples with fresh rumen content was taken as a measure of digestibility by rumen bacteria (5). The effect of the irradiation of basswood on volatile acid production is shown in Fig. 1.

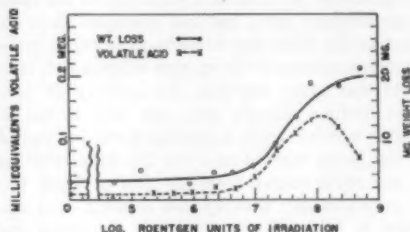


FIG. 1. Weight loss and volatile acid production of irradiated basswood incubated with rumen bacteria.

The cellulose in the untreated wood appears to be relatively unaffected by the enzymatic action of the rumen microbes, and digestibility is not much increased by irradiation up to 6.5×10^8 r. Between 6.5×10^8 and 1.0×10^9 r increased irradiation results in increased fermentability. At 10^9 equiv r the maximum fermentability is reached, and the volatile acids formed constitute 79% of the amount found from an equal weight of filter paper. At this dose the digestibility by the rumen contents is comparable to that of hay. At the point of maximum digestibility the wood becomes hygroscopic and friable. The decrease in volatile acid production for doses greater than 10^9 r can be interpreted to mean that the carbohydrate fraction of the wood has been converted to compounds that are not utilized by rumen bacteria.

Fig. 2 presents the results of assays for pentose, reducing sugars, and free phenolic groups on the soluble components of irradiated basswood. Phenolic groups were run on an alkaline extract of the treated wood. The pentose and reducing sugar were run on a water extract. It appears from these more sensitive tests that the treatment has degraded both the cellulose and lignin components of the wood in the range of optimum digestibility.

Microbiological tests and chemical analyses were run on control and irradiated cellulose (filter paper) and lignin (Scholler's process) to determine if the irradiation had its greatest effect on the lignin and thus exposed the cellulose of wood to bacterial action. Although the lignin appeared to be relatively unaffected by the irradiation, the results cannot be interpreted to mean that it is entirely unaltered, but merely that it is not greatly changed in a manner that is detectable by the chemical and bacteriological tests applied. The bacteriological tests on filter paper showed a decrease in volatile acids from samples irradiated with 3.35×10^8 r, which correlates with the decrease for basswood treated with the same dose (Fig. 1) and supports the interpretation that the de-

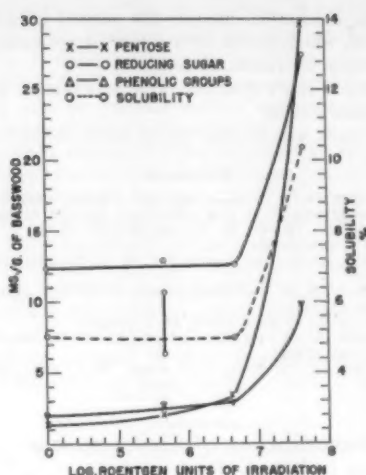


FIG. 2. Effect of radiation on soluble products of basswood. Pentose expressed as mg ribose, reducing sugar as mg glucose, and phenolic groups as mg tyrosine.

crease in acids formed from heavily treated wood samples is due to the destruction of the cellulose. At this dosage cellulose becomes almost completely soluble in water.

The formation of reducing sugars, in the case of cellulose, with increasing dose indicates depolymerization of the fundamental glucose chain. At the dose of 3.3×10^8 r, where the cellulose becomes completely soluble and where the production of fermentation acids starts to show a decrease, it can be estimated that the minimum chain length is approximately six $C_6H_{10}O_5$ units long. In the case of the wood, at this heavy dose, although cellulose is completely vulnerable to attack by the bacteria, it must be assumed that it is no longer in a form that can readily be fermented.

A reduction in particle size to the order of cellular dimensions (a fraction to 6μ), where a larger fraction of the cellulose should be exposed to bacterial fermentation, did not significantly increase the bacterial attack on the unirradiated wood. This suggests that the relative indigestibility of the cellulose in the untreated wood is not due to an encrusting layer of lignin, as often postulated (6). It is possible that the lignin in basswood is of such a material that during the ball-milling it is smeared over the exposed cellulose surfaces to form a protective layer.

Alternative interpretations of the present results could be:

- There is a definite bond between the lignin and the cellulose which, in the natural state, rumen bacteria are unable to hydrolyze. It is the alteration of this bond by the irradiation that is responsible for the increase in digestibility.
- There are natural lignin bacteriostatic compounds or groups such as have been reported in cedar heartwood (7), which are destroyed by irradiation.

(c) The irradiation disrupts the natural cellulose of the wood, which, unlike filter paper, is not susceptible to digestion by rumen bacteria.

The present study does not favor or eliminate any of these possibilities.

This work will be reported in detail elsewhere.

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The Determination of Cholinesterase Activity in Whole Brains of Developing Rats

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The cholinesterase activity of the chick brain has been determined by Nachmansohn (1). Later, Sawyer (2, 3) demonstrated the correlation between cholinesterase activity and motility of the developing embryo of *Amblystoma maculatum*. Using Sawyer's modification of the microtitrimetric method of Gliick (4), we have measured the activity of cholinesterase in the brain of the developing white rat. The experimental data from this investigation are shown in graphic form in Fig. 1.

The determinations were made on rats ranging in age from the 14-day fetus to the adult. In order to obtain embryos of known age, rats were bred during one night and the age of the fetus was considered to be one day at midnight of the first night thereafter. In the 14-day fetus, the earliest stage employed, the fetus weighed less than 0.1 g, and the entire top of the head was considered to be brain tissue. In 16-day

and older fetuses, the brain is sufficiently well outlined to allow removal by dissection.

The cholinesterase content of the 14-day, or earliest, fetal rat brain studied was less than the error of the method, but in the 16-day fetus a measurable quantity of cholinesterase was found. Although the rat fetus shows a considerable increase in size from the 16th day of gestation until birth, the activity of the esterase remains constant until the 2nd postnatal day. From the 2nd to the 22nd day after birth a rapid increase in the concentration of the enzyme is apparent. In contrast to this early increase, the activity of cholinesterase declines sharply from the 26th to the 32nd day, after which there is a gradual decline to the adult level, this being reached at about 120 days after birth.

In our study stages from the day of birth to the 32nd postnatal day were spaced about 2 days apart. In order to bridge the gap between the young stages and the adult, animals of about 2½ and four months of age were included.

The curve obtained when the activity of cholinesterase in the whole brain of the rat is plotted as a function of age is similar to the one shown by Sawyer (2) for *A. maculatum*. In his observations on early embryos, Sawyer used the whole brain and the spinal cord as far caudal as the level of the anus, whereas in studies of some of the later stages he made separate determinations on the brain and the spinal cord. Sawyer found that the activity of the enzyme was present to some small extent even before the larvae were motile, but that the activity began to rise sharply as the organism reached the swimming stage and continued to rise for several days after feeding had begun, reaching a peak about 20 days after initial feeding. From this point the curve declined, rapidly at first, and then more slowly during metamorphosis until it reached, late in development, the level characteristic of the adult. Sawyer found the rapid rise in the enzyme concentration during the early larval period to occur at a time when the larva shows maximum activity as indicated by rapid feeding reflexes and low threshold to external stimuli. The same author postulated that the decline in the activity seen in the adult was due to the development of esterase-diluting structures in the brain.

Our curve showing cholinesterase activity in the rat agrees well with the work of Sawyer. The immaturity of the rat at birth probably explains why changes similar to those found by Sawyer do not occur until the first weeks after birth; nor until 2 days after parturition does the enzyme activity in the rat begin to rise, and then it rapidly increases to a peak on the 22nd day after birth. By the 26th day the activity begins to decline. This decrease, like that found by Sawyer, can probably be explained by the formation of tissue that is not rich in cholinesterase. Angula (5) reports that the 14-day fetus is nonmotile, and from that time until birth there is a slight increase in ability to respond. Stone (6), reporting on the growth of responses in the postnatal rat, reports a rapid in-

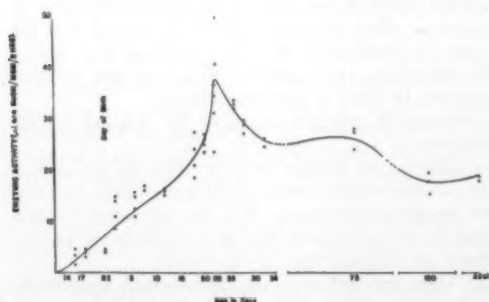


FIG. 1. Cholinesterase activity in the brain of the developing rat.

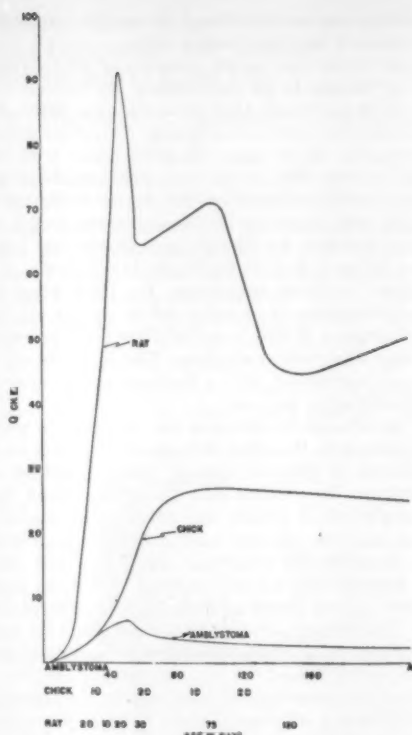


FIG. 2. Comparison of the Q C.H.E. of rat, chick and salamander nervous tissue, during comparable stages of development.

crease in muscle coordination from the day of birth and continuing through the 22nd day, at which time the rat possesses virtually all the adult responses. These data correspond very well with the rise in the esterase content in the rat brain. In the early fetal stage, in which Angula found the animal to be non-motile, the enzyme content was too low to be measured. The development of reflexes is accelerated in the days just following parturition. The rise in esterase activity during this period is probably responsible for the increased use by the organism of functional nervous pathways.

Nachmansohn (1), in his examination of the esterase content in the brain of the chicken, found that the activity of the enzyme increases sharply to the 8th day after hatching and subsequently fell only slightly in the later development. Nachmansohn made a series of determinations from early embryonic stages to the time of hatching. At the 6th day of incubation, the Q C.H.E. was 1.38, increasing to 20.8 at 20 days' incubation, and reaching the highest value of 26.0 at 8 days after hatching. The value for the adult is 25.6. These data show that the curve in the chick begins to rise at an early developmental stage, probably as a result of the very rapid early development of the

embryo within the egg. By the time of hatching the chick is well developed and has most of the adult reflexes. Determinations made by Nachmansohn (7) on a few isolated stages of the sheep embryo indicate merely that the enzyme activity increases from the 75th day to the 138th day of life.

The data relative to the development of cholinesterase in the nervous tissue of *Amblystoma* as described by Sawyer, in the brain of the chick as observed by Nachmansohn, and in the rat brain can be plotted for comparison on the same coordinates in a manner similar to the one employed by Sawyer (3) (Fig. 2). In obtaining our Q C.H.E. values for the rat brain tissue, the fresh weight of the tissue was assumed to be four times the dry weight, this being sufficiently accurate to show the similarity of the curves for the three animals.

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The Effect of Radiations on Galactozymase Formation in Yeast

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Adaptive enzyme formation in microorganisms is reduced or prevented by such cell poisons as azide (1), arsenate (2), and 2,4-dinitrophenol (1, 3), which probably interfere with protein synthesis in general. Since various radiations readily prevent cell division, it has been thought that they interfere with protein syntheses (4). A study of the effects of radiations upon adaptive enzyme formation therefore seemed pertinent. Galactozymase formation in yeast after addition of galactose is easily followed manometrically and occurs in resting cell suspensions in the absence of exogenous nitrogen (1); it is therefore an excellent test material. In a strain of *Saccharomyces cerevisiae* used, the adaptation, after addition of galactose to the suspension of yeast, began in about 90 min at 27° C, as indicated by a rise in rate of oxygen consumption. It was complete in about 180 min, as indicated by the achievement of a maximal rate. In the experiments reported 20 mg of galactose were added to each Warburg vessel containing in the order of 10^7 - 10^8 cells/ml, as determined by a count with a hemocytometer.

Whereas ultraviolet dosages of approximately 18,000 ergs/mm² from a sterilamp striking the face of the vessel merely retard the appearance of adaptation, a dosage twice as large inhibits it entirely. Dosages of ultraviolet sufficient to prevent adaptation have little

effect on the respiratory rate of yeast utilizing glucose. A considerable degree of photoreactivation can be achieved by subsequent illumination with white light, as is discussed elsewhere (5).

When completely adapted to galactose, yeast was irradiated in the presence of an excess of galactose. The respiration was little affected by dosages which would have prevented adaptation had they been applied at the time galactose was first added to an unadapted culture. This bears out the original hypothesis that synthetic processes are sensitive to these radiations and, in fact, it emphasizes the nature of adaptation, since the enzymes directly concerned with galactose respiration, once formed, are not easily affected by ultraviolet radiations.

Ultraviolet radiations act upon proteins in the cell, as shown by the action spectra (4). The possibility that nucleoproteins are involved in the formation of adaptive enzymes has been tested by one of us (12) by a determination of the ultraviolet action spectrum of galactozymase inhibition.

Since x-rays are known to interfere with nucleic acid conversions (6, 7), the effects of x-rays were next tried. A dosage of 4,850 r of x-rays at 40 kv and 20 ma with a tungsten target prevents division of 90% of the cells exposed as a thick paste on the surface of agar. Tests were made by diluting the irradiated yeast and plating in the standard way, counts being made 24, 48, and 72 hr following incubation at 30° C. In spite of this effect on viability, no noticeable effect was observed on the adaptation of the yeast to galactose. The increased respiration, indicating use of the galactose, occurred simultaneously in both irradiated and control cultures and to the same extent in both. Not only is the adaptation normal, but response to glucose is about the same in irradiated and control cultures. X-rays, as used here, appear to have relatively little effect on total respiration of the cell and on adaptive enzyme formation. However, experiments in another laboratory (8) have demonstrated effects of x-rays on anaerobic activities of yeast. Anaerobic adaptation to galactose required several days in our strain of yeast; therefore the effect of x-rays on the adaptation process could not be effectively studied, since in this much time so many other factors might vitiate the study.

The failure of x-rays to prevent adaptation is most surprising in view of the effects of x-rays on nucleic acid conversions. If such conversions are involved in galactozymase formation, one would anticipate effects on adaptation. X-rays readily affect enzymes with SH groups (9, 10), the latter being oxidized by the peroxide formed by dissociation of water by the radiations. Such inactivation is reversed by an appropriate reducing agent. It may be that the enzymes involved in galactozymase formation do not depend for their activity upon such groups, and that therefore they are relatively insensitive to x-rays. Enzymes may be irreversibly inactivated by direct hits (target theory), but the probability is much smaller and the dosages required are much larger (9, 10). Perhaps for that

reason no measurable change in aerobic adaptation was observed with the dosages used.

Since visible light in the presence of photodynamic dyes is thought to act superficially on the cell (11), one might anticipate that it would have little effect upon adaptive enzyme formation. However, parallel experiments using yeast photosensitized with rose bengal proved that in this case light interferes with adaptive enzyme formation, the degree of change increasing with exposure. In these experiments the cells were illuminated for 15 min in 1:40,000 rose bengal with a 100-w G-E CH4 Spotlamp at a distance of 70 cm from the yeast suspension, the light being first passed through a 15-ml water cell to remove the heat and through a #3389 Corning glass filter to remove the long ultraviolet radiations. The intensity of the lamp as determined with a thermopile was approximately 500 ergs/mm²/sec.

In an attempt to interpret the results with photodynamic action, the effect of a similar exposure on the respiration of yeast in glucose and on viability was determined. The results were found to depend upon the time at which glucose was added. If it was added before exposure, the cells were little affected. If added after exposure, the exogenous respiration was markedly reduced and the cells were sterilized, as shown by their lack of ability to form buds in nutrient solutions. The tentative conclusion is drawn that the entry of materials is in some way reduced or prevented after photodynamic action.

The experiments indicate that each of the radiations tested acts in a different manner upon galactozymase formation. Photodynamic action of visible light seems to be confined to the surface, since the effects on respiratory systems depend upon whether the nutrient is added before or after exposure. Ultraviolet light appears to strike deeper and prevents galactozymase synthesis, since a dose which prevents adaptation has no measurable effect on respiration of glucose added after exposure, showing that entry of nutrients is not blocked by action of the radiations. The apparent correlation between adaptation and division of cells by photodynamic action and ultraviolet radiations suggests a close relation between processes governing the division of cells and adaptive enzyme formation. However, the observation that x-rays as tested prevent division but have no effect on galactozymase formation suggests that the two processes pass along separate pathways.

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A Special Cannula for Determination of Blood Flow in the Left Common Coronary Artery of the Dog

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Gregg and Shipley (1, 2) have measured coronary inflow in dogs by cannulation of the left common coronary artery via the aorta with cannulae inserted through a carotid or left subclavian artery. More recently Eckstein (3, 4) and Eckel (5) have reported total left coronary flow studies made with a special cannula described by Chambliss (6). All these cannulae must be inserted a sufficient distance into the coronary artery to be secured by a ligature. The use

filled with heparinized blood. The cannula tip is inserted into the aorta through the left brachiocephalic artery and the artery ligated about the shaft of the cannula. Loop *G* is inserted into holes *E* and *E* in holder *D*. The tip is passed along the left aortic wall to the level of the aortic valves until the arm of holder *D* can be connected to cannula arm, *B*, by the insertion pin *C*. Spring *K* is then attached to hook *L*, thereby compressing the aortic wall. The cannula is so constructed that when all parts are joined in this manner the cannula falls into the proper position.

Several details of construction are important for ease of operation and accuracy of recording. The cross section from *I* to *L* must be uniform to prevent blood leakage around the cannula when the tip is advanced to the coronary ostium. To achieve this end the needle is soldered in a groove in the cannula wall. The orifice *I* of needle *J* is placed on the right side of the cannula

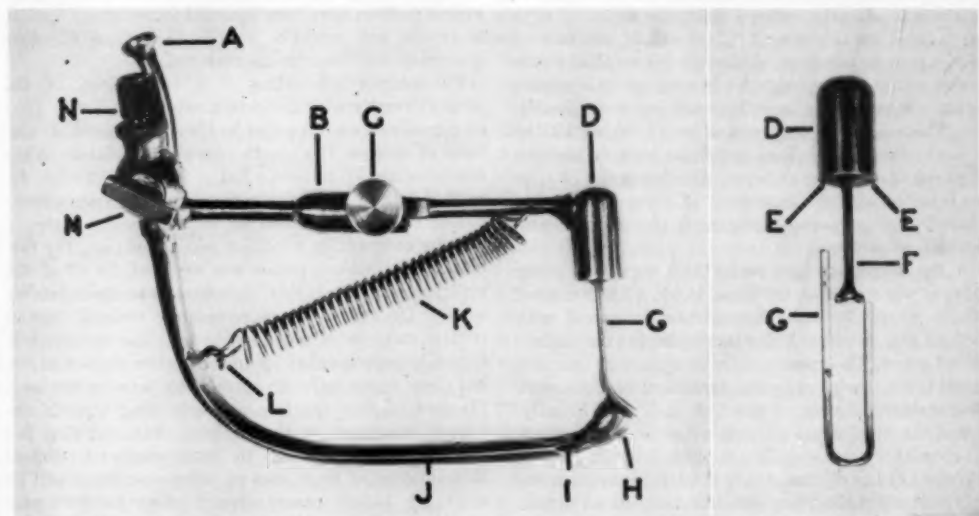


FIG. 1. Left, side view of stainless steel cannula; right, front view of holder and wire loop (both actual size).
A, Cannula connection to rotameter; B, cannula arm; C, pin; D, holder soldered to holder arm; E and E, holes in holder for arms of loop G; F, centerpiece which completes ring with G; G, 1/16-in. spring steel wire loop which fits around left common coronary artery; H, cannula tip; I, orifice of needle; J, 17-gauge spinal needle for recording aortic pressure; K, steel spring; L, hook for spring; M, stopcock; and N, connection to aortic pressure manometer.

of even the special cannula may be impossible because of a short left common coronary artery. Frequently the septal and other branches may be occluded. These difficulties may be circumvented by the self-retaining cannula which is shown in Fig. 1. This cannula is not tied in place, but is held over the coronary orifice by counter pressure applied to the external aortic wall.

The left common coronary artery is exposed at the aorta and the long arm of loop *G* is passed under it until the artery lies in the loop. The cannula is connected at *A* to the output tube of the rotameter and

to record true aortic pressure when the cannula lies in position. Holder *D* and its arm have been designed to prevent impingement upon the pulmonary artery or the heart wall by the holder.

The proper positioning of the cannula may be tested by clamping the rotameter input and opening a side-arm in the tube connecting the cannula to the rotameter output. Any leakage from the aorta past the cannula tip into the coronary artery will be demonstrated by blood dripping from the side-arm. Post-mortem injection of India ink under pressure through the cannula has shown satisfactory perfusion of all branches of the left common coronary artery in all experiments in which the cannula has been used, and no reflux

¹ This study supported by a grant from the Division of Research Grants and Fellowships, U. S. Public Health Service.

around the cannula tip into the aorta has been demonstrable. With this cannula it has been possible to measure total left coronary inflow in vessels impossible to cannulate by other techniques.

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Developmental Abnormalities in Chick Embryos Treated with Sugar

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As a part of a problem concerning the carbohydrate metabolism of early embryo chicks, a series of eggs was treated by injecting 1 ml of a 2-M solution of sucrose into the albumen. Although this treatment was carried out at various ages of incubation, the present report concerns only eggs injected prior to incubation. These eggs were opened after 72, 96, or 120 hr of incubation, and whole-mount slides or serial sections prepared of all living embryos. Another series of eggs was injected with a like amount of normal saline, incubated, and prepared along with the experimental material, as controls.

In the sucrose-treated series 195 eggs had living embryos when opened. Of these $44.5\% \pm 3.6\%$ showed definite morphological abnormalities, compared with $8.3\% \pm 1.8\%$ of 234 living embryos in the saline-treated series. The great variety of abnormal morphological types produced by this treatment is of interest. These malformed embryos resemble each other broadly, in that the most usual affected areas are the nervous and circulatory systems. This might be expected, since, as Weiss (1) has discussed, any deleterious agent seemingly will affect the more sensitive areas of an organism first, and more severely than less susceptible parts. The stages treated here—0–72 hr, 0–96 hr, and 0–120 hr—cover the period when these two systems are particularly active in growth and differentiation. However, the specific syndromes of abnormality found within this broad general pattern show extreme variation, ranging from suppression or atypical development of a single region, such as the eye, to a completely amorphous mass, or to complete absence of an embryo from the blastoderm. No one specific syndrome of abnormality occurs in a significant percentage of the material; rather a large number of abnormal conditions reported in the literature of being produced by experimental treatment of various types seem to have been closely duplicated here.

To cite a few such examples: The "rumplessness" produced by Landauer (2) by injection of insulin or other chemicals, and described by Moseley (3) appears in 8 embryos. The various abnormalities of the

central nervous system, particularly the "sinuous nervous system" described by Catizone and Gray (4) after treatment with lead salts, and by Hansborough (5) as being produced by nicotinic acid, appear to be duplicated in 13 embryos. The presence of a double heart, shown by Szepeswol (6) and by Waddington (7) to be brought about by operative injury, occurs in two examples. The author believes, however, that he has ruled out mechanical injury as a factor in the present work. Gray and his co-workers (8, 9), in two interesting abstracts, have shown that the injection of certain optically active compounds will significantly change the percentage of occurrence of heterotaxic embryos. In the present experiment, $9.7\% \pm 2.1\%$ of the treated embryos were heterotaxic compared with $2.8\% \pm 1.1\%$ in the saline-treated controls. These heterotaxic embryos often show other abnormalities in varying degrees, but only embryos that were nearly enough "normal" to determine their essential morphological pattern have been included in the above figures. Gray did not comment on the occurrence of other abnormal conditions in his material.

Particularly interesting is a comparison of the present results with the recent report by Eakin (10) on amphibian embryos that had been immersed in solutions of sucrose. His results also show variation in the abnormalities produced. Eakin has specifically described failure of pituitary development. Upon examination of sectioned embryos in the present series, a broadly comparable condition was found; i.e., the formation of Rathke's pouch was atypical. In 13 of the embryos examined this structure was considerably smaller (in two instances completely absent) than in control embryos of comparable age. This condition is typically accompanied by various other abnormalities, but there seems to be no correlation between the suppression of this structure and any other specific abnormal condition. In the material examined thus far the infundibulum seems to be normally developed. Examination of more, and of older, specimens will be necessary before commenting further on this particular condition.

Eakin (10) has offered several possible suggestions as to the cause of the anomalies produced in his experiments, without specifically attempting an analysis of those causes. The present author can do little better. According to Needham (11), the chick embryo during the stages under discussion is largely dependent on a carbohydrate metabolism as a source of energy for growth and differentiation. Landauer (12) believes that the various abnormalities produced in his work result from interference with this metabolism. It would seem possible that sucrose reacts with the embryonic system in some such fashion, disturbing the basic developmental patterns, and being remarkably non-specific in its effects. When any material is injected into an egg, as in this work, there is obviously no control over its subsequent distribution. Time and spatial factors may enter in, so that the embryo or a region of the embryo may well be exposed to dif-

ferent concentrations of the material at different stages in development. If sucrose is capable of affecting development during these stages, as seems evident (whatever the specific effect may be), this might well explain the great variety of anomalies produced. As Weiss (1, 483) has pointed out, "Not only may the same type of malformation arise in various ways, but various kinds of malformations may also be caused by the same disturbance." The present results seem to be another illustration of this point.

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Quantitative Microdetermination of Amino Acids after Paper Chromatography¹

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Paper chromatography (1) and microbiological determination are the two most useful modern methods of protein analysis. Paper partition chromatography was initially only a qualitative or semiquantitative method, which several workers soon tried to improve so as to meet quantitative standards. Generally this has been attempted by employing the ninhydrin reaction and measuring the color and area on the paper (2-4) or by extracting the amino acids from the paper spots and performing the ninhydrin reaction or a copper amino nitrogen determination (5-9). Even with these refinements, however, the estimation of the amino acids is only approximately quantitative, or the process is tedious, especially when it is necessary to extract the amino acid and use special reagents.

We have been using a method which results in the accurate determination of quantities of amino acids of about 10 γ ; only rarely (in the case of histidine) is it necessary to use a greater amount of the compound (Table 1) to obtain a proportionality between the color produced and the quantity of amino acid present in the paper spot. Our procedure consists in (1) localizing the spots on the paper and marking lightly their limits with a pencil, under an ultraviolet lamp; (2) cutting the spots, introducing them in a volumetric 10-ml flask and developing a color reaction with ninhydrin; and (3) measuring the color intensity at the

¹ This work was aided in part by a grant from the Instituto para a Alta Cultura, Lisbon, to one of us (A. P.).

TABLE 1

Quantity of amino acid (in γ)	Optical density (2-cm cell)					Histidine monohydrochloride
	Glycine	Alanine	Valine	Glutamic acid	Phenylalanine	
3	0.13					
5	0.17	0.16	0.14	0.09	0.09	
7	0.20					
10	0.29	0.25	0.21	0.15	0.12	
15		0.34	0.29	0.22	0.16	
20						0.16
30						0.21
40						0.27

end of the reaction. Localization of the spots by ultraviolet fluorescence is possible only after the paper is dried at room temperature for some days or heated at 100°-105° C for about 5 min. We prefer the heating. According to Patton *et al.* (10), this fluorescence is essentially due to the paper surface being modified by deposition of the amino acid.

The marked spots are cut, introduced into a 10-ml dried volumetric flask, and 0.5 ml of an appropriate ninhydrin solution is added. The volume of ninhydrin solution must be less than 1 ml, otherwise the reaction becomes less sensitive. The flasks are heated for 15 min in a bath of vigorously boiling water, with occasional shaking, and are then immersed in water at room temperature for about 5 min. Distilled water is added, and the color intensity is measured in a colorimeter. Meanwhile, the piece of paper is allowed to remain in the volumetric flask, the error due to it being negligible. For the colorimetry we use a Lumetron colorimeter with a 550-m μ filter and a microcell 2 cm thick.

A blank with a piece of filter paper, of about the same size as that with the spot, and ninhydrin reagent are prepared in the same way. We found that the blanks gave the same values for widely different pieces of paper and therefore may be neglected when comparative results are being obtained—that is, when pure amino acids are used as the standard. Of course, after the use of ammonia in paper chromatography, it is necessary to eliminate this compound; otherwise the blank may be variable.

The ninhydrin solution must be almost neutral, since the optimum pH for the reaction, without the use of reducing agents, is about 7. For the small volume in which the reaction is performed the contribution of the piece of paper to changing the pH may be very important. We noticed that different papers (Whatman No. 1, No. 2, and others), when immersed in 0.5 ml of ninhydrin solution, may more or less strongly modify the pH. This is especially true after developing the chromatogram. The contribution of the amino acid to alteration of the pH is negligible. It is necessary, therefore, to correct the pH of the acid aqueous ninhydrin solution with a buffer to obtain a final pH

of 6.80–7.0. We used the following ninhydrin solution with good results: A fresh 1% ninhydrin solution in water is mixed with an equal volume of a sodium veronal-HCl buffer of pH 7.0. This pH is obtained by mixing 5.36 volumes of 0.1 M sodium veronal with 4.64 volumes of 0.1 N HCl.

Table 1 illustrates the results we obtained with pure amino acids.

The sensitivity of the ninhydrin reaction is different depending on the amino acid (11, 12), histidine being the least sensitive. The lower quantities of amino acid mentioned in the table give values greater than expected; the reaction is quantitative only above these lower limits. For glycine the Lambert-Beer law is followed only above, and including, 5 γ ; for alanine, valine, glutamic acid, and phenylalanine the lower quantitative limit (inclusive) is 10 γ , whereas for histi-

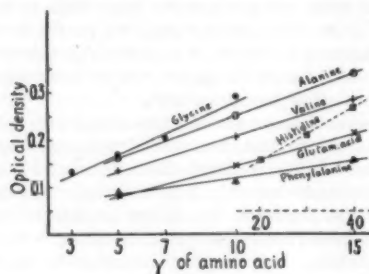


FIG. 1.

dine this limit is 25 γ . Fig. 1 illustrates this, showing that for the quantities employed, optical density is directly proportional to concentration.

In order to determine an amount of amino acid below the lower quantitative limit, a known quantity of amino acid is added to the paper spot with a fine capillary pipette (e.g., 0.005 ml and 10 γ of amino acid), and afterwards the reaction is performed as usual, the piece of paper with the spot having previously been dried. For the quantities of histidine normally found in proteins it is generally necessary to add a small amount of this compound to the respective spot in paper chromatographies corresponding to about 200–400 γ protein, to obtain a quantitative color reaction.

We hope that the procedure will prove to be useful also in the hands of other workers. The reproducibility of the method lies in general within an error of 3–5%, and duplicates usually give errors inferior to this.

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Evidence for the Heparin Nature of the Nonspecific Hyaluronidase Inhibitor in Tissue Extracts and Blood Serum¹

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The possible role of the nonspecific (nonantibody) hyaluronidase inhibitor of blood serum in the animal body, and its remarkable changes in concentration in infectious diseases, cancer, liver and kidney damage, and many conditions of stress (1), led to an earlier study (2) of its anatomical origin. A wide variety of tissues from the rabbit was investigated as possible sources of the serum inhibitor, but it could be demonstrated in none of the tissue extracts obtained. This might be explained by the very low concentration of inhibitor in these tissues. It was further found that certain steroids and hemoglobin derivatives were inhibitors *in vitro*, but none of these could be the serum factor in question since the latter is heat-labile and its effect is decreased in the presence of phosphate. It is well known that isolated polysaccharides of the heparin group are potent inhibitors (3–9), and, as our work developed, evidence accumulated suggesting that the native heparin-protein complex (10) probably present in low concentrations in normal serum (11) might exert a hyaluronidase inhibition. It should be mentioned that certain mucoproteins of human serum prepared by the perchloric acid method of Winzler *et al.* (12) were devoid both of anticoagulant (13) and hyaluronidase inhibitor activities (14).

The first suggestion as to the chemical nature of the nonspecific hyaluronidase inhibitor was provided by the finding that most of the serum inhibitor migrated with the albumin in the electrophoretic field (15), a finding later confirmed (16). It was previously known that purified commercial heparin added to plasma migrated with an electrophoretic mobility intermediate between that of heparin and albumin (17). This seems also to be the case for one of the components obtained by electrophoresis of the native heparin complex obtained from ox liver capsule extracts (18).

¹ This investigation was supported by research grants from the National Institutes of Health, Public Health Service, the Medical Research Fund of the Graduate School of the University of Minnesota, and by grants from the Caroline Institute, the Swedish Medical Association, and Swedish Cancer Research Funds.

From recent work on the chemical purification of the inhibitor it was observed that protamine,² which is known to precipitate the polysaccharide part of the native labile heparin complex from serum (18), also precipitates the inhibitor. Details of the use of protamine in the inhibitor purification will be given elsewhere (19). It was also found that peptone shock in rabbits caused not only the usual rise in the concentration of heparin in the blood serum, but also an elevation of the inhibitor concentration (20). If the heparin increase was blocked by intravenous injection of India ink prior to peptone shock, following the method of Volkert (21), no rise in inhibitor concentration was noted (20).

TABLE 1

PERCENTAGE INHIBITION* OF TESTIS HYALURONIDASE AND HEPARIN CONCENTRATION OF TISSUES RICH IN MAST CELLS

	Liver capsule (cow), %	Endometrial carunculae† (heifer), %	Swim bladder‡ (whitefish), %
(A) Inhibition by 1.5 ml tissue extract§	4	14	20
(B) Inhibition by 0.04 ml human serum	11	19	25
(A) + (B)	26	49	53
Heparin in extract (mg %)	1.5	4.6	5.1

* Inhibition determined by the method previously used (2).

† Obtained through the courtesy of A. F. Weber, Department of Veterinary Medicine, University of Minnesota.

‡ Obtained through the courtesy of A. J. Walstad, Booth Fisheries Corp., Bayfield, Wis.

§ Extract prepared by grinding tissue in a Wiley mill, extracting pulp with 0.9% NaCl (5 ml/g tissue) for 2 hr at 5°C, centrifuging, and filtering supernatant through a sintered glass funnel.

Since mast cells contain a heparin-lipoprotein complex provisionally considered to be associated with the microsomal fraction of their cytoplasm (18), tissues particularly rich in these cells were investigated as possible sources of inhibitor. These proved to be the only exceptions observed to the previously reported absence of inhibitor in a variety of tissues (2). Thus, in Table 1, it may be seen that the three tissues chosen for their high mast-cell content all yielded extracts containing inhibitor, and when these extracts were combined with human serum, the mixtures had more than the additive amount of inhibitor. The basis of this mutual enhancing effect is not known. The colorimetric Azure A method (11) employed for the heparin analysis is far from precise, but it is capable of a certain degree of semiquantitation. It will be noted in the table that the order of inhibition and approximate heparin content of the tissue extracts were parallel.

It should be pointed out that radiation sickness, which is accompanied by a hemorrhagic condition, has

* The authors are indebted to W. A. Lott, E. R. Squibb & Sons, for a generous gift of protamine sulfate.

been shown to be associated with an increase of serum heparin (22-24). It has been found recently that total-body x-irradiation of rabbits resulted in an elevation of the serum inhibitor concentration (25).

Finally, in connection with other investigations by B. Sylvén, O. Snellman, and co-workers, samples were repeatedly prepared by means of differential centrifugation of fresh ox liver capsules. These contained various amounts of the native heparin-lipoprotein complex which possesses very high metachromatic and anticoagulant activities. The electrophoretic mobility of the active fraction was 5.9×10^{-5} u (18). In these separations acetate and veronal buffer media were employed, and the samples were shipped from Stockholm to Minneapolis by air in the frozen state in thermos bottles packed with solid CO₂. On arrival the material was still frozen. The amounts of heparin present in the different samples had been assayed by the thrombin method of Jaques and Charles (26). After thawing, the liquids were assayed for inhibitor activity. In three different preparations, 33% inhibition was given by 1.5 ml of each of the solutions, containing the equivalent of 45, 60, and 40 µg commercial heparin (Vitrum, Sweden), respectively.

The evidence presented shows that the native heparin-lipoprotein compound obtained from tissues rich in mast cells is a hyaluronidase inhibitor. It is possible that this or part of this heparin compound is responsible for the nonspecific hyaluronidase inhibition given by serum. Final proof will depend on the isolation of this serum factor and its comparison with the isolated tissue heparin complex.

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Control of Covered Smut of Oats by Seed Treatment with an Antibiotic¹

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The possibility of controlling plant diseases caused by seed-borne pathogens by seed treatment with antibiotics has been explored in a few instances in the laboratory (1-4), and reduction in severity of disease by this means has been reported (2).

In order to determine if field control of important seed-borne pathogens could be achieved by seed treatment with antibiotics, experiments were performed at the University of Alberta in 1950 with two known antibiotics, actidione and streptomycin, and certain smut fungi causing covered smuts of wheat, barley, and oats. Infested seed used was naturally smutted and was obtained from Alberta farmers.

Actidione proved promising, particularly for the treatment of oats for the control of covered smut caused by *Ustilago kolleri* Wille. At the concentration used—10 ppm in water—it gave almost complete control of covered smut of oats without injuring the seed significantly, whereas streptomycin at a much higher concentration—1,000 ppm—failed to control this smut. In the case of barley, actidione reduced covered smut significantly without appreciable injury to the seed, but streptomycin gave no reduction in the amount of smut of this grain. Least promise from treatment with these antibiotics was shown in the case of wheat, mainly because of injury to the seed. Both caused significant reduction in emergence, and streptomycin produced very serious seed injury. Complete control of covered smut of wheat was obtained with actidione, but the severity of infection in check plots was low (2-4%). The results with oats only are presented in Table 1. Data for a number of commercial fungicides are also included. It is noteworthy that covered smut of oats is a major disease of an important crop and that it is one of the covered smuts most difficult to control successfully by seed treatment.

It may be seen from the table that the antibiotic actidione compared favorably with the mercurials Ceresan M and Panogen 8² and with formaldehyde in the control of covered smut of oats. The fact that

¹ Financial assistance from the National Research Council of Canada is gratefully acknowledged.

² Kindly supplied January 4, 1950, by the Upjohn Company, of Kalamazoo, Mich., through the courtesy of J. H. Ford.

W. H. Minshall, botanist, Division of Botany and Plant Pathology, Ottawa, has been transferred to the new Science Service Laboratory of the Dominion Department of Agriculture at London, Ontario.

The Saratoga Experimental Gardens opened January 1 in Saratoga, Cal., on the western side of the

TABLE 1
COMPARATIVE RESULTS OF SEED TREATMENT WITH
ACTIDIONE, STREPTOMYCIN, AND COMMERCIAL
FUNGICIDES IN THE CONTROL OF COVERED
SMUT OF HULLED OATS

Chemicals used in treatment of seed	Concentra- tion or amount	Time treated	Av emergence*	Av percentage of smutted plants*
Actidione	10 ppm	4 hr	128.0	0.2
Streptomycin				
sulfate	1,000 ppm	4 "	126.5	12.9
Ceresan M	1/2 oz/bu	—	137.5	0.0
Panogen 8	.12 cc/50 g seed	—	133.8	0.0
Formaldehyde	1: 320	2 min	139.0	3.7
None (Ck†) dry	—	—	137.8	10.8
None (Ck†) wet	—	4 hr	151.5	16.6
L.S.D.	—	—	n.s.	4.3

* Obtained from field plots each sown with 200 seeds and consisting of a 12-ft row. Treatments were replicated 4 times and randomized.

† Ck = Check: dry check was untreated, and wet check was soaked in water for 4 hr.

formaldehyde failed to give complete control of the smut in these tests suggests that the sample of oats used carried a rather persistent type of infection. As measured by emergence, the actidione treatment appeared to effect control of covered smut of hulled oats without serious toxic action on the seed. No yield data were taken, but the general condition of the plants from seed treated with actidione appeared as satisfactory as that of the plants from seed treated with the mercurial fungicides.

The results demonstrate that field control of an important plant disease caused by a seed-borne fungus is possible by seed treatment with an antibiotic. The fact that the treatment with actidione in these experiments controlled covered smut of oats in a naturally smutted sample indicates that it might be expected to give a similar degree of control under farm conditions. The treatment as used is not one for immediate practical application, however. It does appear sufficiently promising to warrant further experimental work in the treatment of seed with actidione and other antibiotics.

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Santa Clara Valley. Research will be undertaken on the selection and propagation of the best available strains of shade trees and native shrubs of California. Maunsell Van Rensselaer, director of the Santa Barbara Botanic Garden for 16 years, will be director. His assistants will be Thomas Marken and Dudley Phelps.

Comments and Communications

Volcanism—A Contributing Factor to Major Change in Sea Level

WE KNOW that during the Tertiary there were considerable changes in the level of the sea. We know, also, that the Tertiary was a period of active and extensive volcanism. From the bottom of the Pacific alone there have been poured out millions of cubic kilometers of lava, and the total outpourings on the bottoms of the seas are vastly greater than is generally believed. The number of submarine masses exceeds those that reach the surface and are marked as islands on maps. Perhaps some single masses have displaced more than 50,000 km³ of water, and the volcanic outflow in the Hawaiian area alone may amount to 500,000 km³.

With only our present inadequate surveys and data on which to base opinions, it is very difficult to arrive at anything more than a very rough approximation of the amount of displaced water. It should be left to the geophysicists to calculate the probable rise in sea level caused by this displacement, but it appears possible that volcanic activity has displaced enough water to raise the level of the sea as much as 500 m—perhaps more, even if generous allowance is made for compensating subsidence. If such a theory can be substantiated, then answers to some of our perplexing problems connected with sea level changes may be at hand.

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Antiquity of Man in America Demonstrated by the Fluorine Test

THE fluorine content of Miocene horse bones from Florida has been reported in *SCIENCE* (112, 620 [1950]). Investigations are currently being conducted also on the fluorine content of putatively ancient human and associated extinct animal bones from the same state (personal communications from R. F. Heizer and E. H. Sellards). It is hoped that fluorine tests will decide the questions of contemporaneity and relative antiquity of such disputed specimens as Melbourne man and Vero man.

As was pointed out in the article referred to, the fluorine test for relative antiquity is not new. Some of the investigations upon which it is based were carried out in France during the early part of the 19th century. Revival of interest in the procedure is due in the main to Kenneth Oakley, of the British Museum (Natural History), who has provided new datings for such famous Old World specimens as Piltdown man, Swanscomb man, and Galley Hill man.

Considering the ready acceptance of Oakley's find-

ings and the present industrious application of the test to American problems, it is astonishing that the fluorine dating of the Natchez human pelvic bone published in *The American Naturalist* (29, 301, 439, 719) by Thomas Wilson in 1895 has gone unrecognized. If Hrdlička knew of this publication when he wrote his *Skeletal Remains Suggesting or Attributed to Early Man in North America* (*Bur. Am. Ethnol., Bull. 33* [1907]), he failed to mention it. This might be expected because Wilson's conclusions are contrary to those of Hrdlička. The latter concluded on morphological grounds that the Natchez pelvic bone was that of a recent Indian, whereas Wilson concluded from the fluorine content that this bone was as ancient as an associated *Myiodon* bone.

Beginning in 1881, Thomas Wilson spent 5 years in the consular service in Belgium and France. After this he traveled and studied in Europe for 2 more years, and in 1887 he succeeded Charles Rau as curator of prehistoric archeology in the U. S. National Museum. These biographical facts undoubtedly explain his interest in the early French efforts to interpret the fluorine content of human bone. He found the experiments of Adolphe Carnot of Paris particularly illuminating and devoted considerable space in his own paper to their translation.

Although the fluorine test was known to other American anthropologists (*Science*, 21, 262 [1893]), Wilson alone seems to have had the imagination to apply it to a problem in American prehistory. His reasons for utilizing the Natchez bone were probably (1) the publicity given this specimen a short time before by the geologist Leidy, and (2) the willingness of the Academy of Natural Sciences in Philadelphia to furnish samples for testing.

A first sample was tested for fossilization by W. F. Hildebrand, a chemist of the U. S. Geological Survey stationed in the National Museum. He found that "the human bone is in a higher state of fossilization than is that of the *Myiodon*."

A second sample was tested for fluorine by R. L. Packard, a Washington chemist working in the Museum laboratory. Commenting on Packard's report, Wilson points out that

the fluorine in the *Myiodon* was 0.28, in man 0.38, . . . A reference to [Carnot's] tables will show that for modern bones the average as calculated from twelve specimens, is 0.058. By the same table the Quaternary bones were shown to be 0.36. [He goes on to say that the test] . . . shows two things, (1) that . . . the bones under present consideration, the man and the *Myiodon*, are substantially of the same antiquity, and (2) . . . their antiquity is about midway between the modern bones and those of the Quaternary geologic epoch.

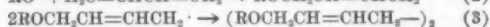
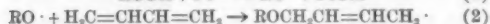
Failure to recognize this finding may be due to the ambiguous title under which it was published: "*On the Presence of Fluorine as a Test for the Fossiliza-*

tion of Animal Bones." In any case, for 55 years anthropology has been deprived of an important objective argument in favor of the antiquity of man in America.

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The Formation of Free Alkoxy (RO·) Radicals in Solution

Many investigators,¹ on the basis of indirect evidence, have postulated the formation of alkoxy (RO·) free radicals in the course of the decomposition of hydroperoxides by ferrous salts. Direct evidence of the formation of such radicals in the aqueous phase has been obtained by carrying out the decompositions in the presence of butadiene. The products identified are accounted for by reaction sequences of the following type.

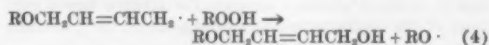


The yields of dimer vary somewhat with the nature of the hydroperoxide decomposed. With butadiene the best yield (85%) was obtained by decomposing *t*-butyl hydroperoxide; decomposition of α -cumyl hydroperoxide and hydrogen peroxide yielded, respectively, 65% and 30% of the dimeric products.

Butadiene forms, in addition to the dimer formulated in equation 3, smaller amounts (15–20%) of isomeric products—probably $[\text{ROCH}_2(\text{H}_2\text{C}=\text{CH})\text{CH}-]_2$, together with some $\text{ROCH}_2\text{CH}=\text{CHCH}_2\text{CH}(\text{CH}=\text{CH}_2)\text{CH}_2\text{OR}$. These isomeric products have been separated from the principal dimeric product $[(\text{ROCH}_2\text{CH}=\text{CHCH}_2)_2]$ by fractional distillation under reduced pressure.

The carbon-hydrogen content and the molecular weight of the principal dimer are consistent with the empirical formula given above. Evidence of structure has been obtained by ozonolysis and oxidation to succinic acid (isolable to the extent of 80% of the calculated amount), and by hydrogenation and subsequent hydrolysis of the saturated diether. These procedures gave the 1,8 glycol, which was identified by conventional methods.

It is of interest that, when hydroperoxide decomposition is carried out in the presence of a polyamine (e.g., triethylenetetramine) and traces of an iron salt, the butadiene product formed is of the type $\text{ROCH}_2\text{CH}=\text{CHCH}_2\text{OH}$.² This fact suggests that, under the specified conditions, the intermediate free radical (formed as indicated in equation 2) reacts with the hydroperoxide.



¹ For leading references see: Kharasch, Fono, and Nudenberg, *J. Org. Chem.*, **15**, 763 (1950).

² These experiments were carried out with E. H. White.

Additions of alkoxy free radicals to isoprene, to simple 1-alkenes, and to allyl alcohol have also been studied. They will be reported in detail in the near future.

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Formation of Colloidal Sulfur

THE recent article by Akiya, Nomato, and Okui (*Science*, **112**, 463 [1950]) concerning the effect of ultrasonic waves and nitrous acid on the production of colloidal sulfur prompts the writer to report on some work done at the University of Wisconsin by C. H. Sorum and the undersigned.

The kinetics of the reaction between thiosulfate ion and nitrite ion in dilute aqueous acid were studied, using the change in pH with time and the change in thiosulfate ion concentration with time. The rate law was found to be

$$-\frac{d[\text{S}_2\text{O}_3^{2-}]}{dt} = k[\text{NO}_2^-]^{1.4}[\text{S}_2\text{O}_3^{2-}]^{0.6}[\text{H}^+]^{2.0}$$

Since both iodine titer and hydrogen ion concentration decreased in the course of this reaction, indicating the formation of $\text{S}_4\text{O}_6^{2-}$, it is hard to reconcile these data with the conclusions of the authors of the above-mentioned article (for their mechanism would hold if the iodine titer and hydrogen ion concentrations increased).

In our studies, the reaction was observed to take up hydrogen ions quite rapidly in acid solution, for the half-life of the reaction at pH 4.0 is less than 1 min. The formation of elemental sulfur is dependent on the concentrations of thiosulfate ion and hydrogen ion, a fact well demonstrated by the work of La Mer and co-workers (Kenyon and La Mer, *J. Colloid Sci.*, **3**, 163 [1949] and preceding papers). If one assumes the following stoichiometry,



a simple and consistent explanation for the retardation of colloidal sulfur formation by nitrous acid is obtained.

The yellow color, which was ascribed to an unstable intermediate in the first-mentioned article, was observed in our kinetic investigation. Since the rate of its appearance qualitatively followed the reaction rate law for thiosulfate oxidation, we feel it is probably nitrogen dioxide formed by oxygen and nitric oxide.

If desired, further details may be obtained from the writer, or from the thesis filed in the library of the University of Wisconsin at Madison, Wisconsin. As much work remains to be done before a satisfactory mechanism can be postulated, we are not planning any publication of our material at this time.

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Book Reviews

Culture in Crisis: A Study of the Hopi Indians.

Laura Thompson. New York: Harper, 1950. 221 pp. \$4.00.

This is a study of an American Indian tribe living under socially critical conditions. Many scientists participated in making the original observations and in analyzing them, but Dr. Thompson is wholly responsible for the analysis presented in this fascinating volume. The Hopi Indians of the Southwest and their communities are her subjects, but the principal subject of the book is the dynamics and effects of the white man's impact upon Hopi personality and Hopi social structure. Dr. Thompson gives a very clear account of what is known of the history of Hopi society and then describes Hopi society as it is today. The analysis of Hopi personality structure suggests that to the Hopi the world appears as a complex, balanced power system regulated by an inherent rhythmic principle. Everything that exists holds together in an interdependent relationship. Man, animals, plants, the elements, the supernatural powers, interact in an orderly rhythmic fashion, for the good of all. Man, however, has a certain measure of control over the world.

Introduce into a society living by such beliefs Menonite and Baptist missionaries with their doctrines of sin, together with the whole apparatus for producing a sense of guilt, and the disintegrating effects upon personality and ways of life become tragically inevitable. Add to this the hypocritical behavior of the U. S. government toward its Indian wards—of which Dr. Thompson writes objectively—and the picture becomes a sad one indeed. Someone once remarked that the trouble with the Red Indian is that he has been too much tied up in red tape. The truth is, unfortunately, much worse than that, and Dr. Thompson tells it clearly and frankly. The new Indian Service policy instituted in 1934 commits the government to a wiser and more humane policy, and Dr. Thompson gives a valuable account of the positive effects of this policy on Indian welfare.

Her analysis leads her to conclude that the core of the Hopi crisis is ideological. The acculturation process has thrown the basic ideological dynamic of the Hopi out of order. In her final chapter the author offers recommendations which, put into practice, would almost certainly help solve the Hopi problem. The analysis and the approach to the solution of the problems of culture in crisis made in this book present a scientific methodology by which similar problems may be approached wherever they may occur.

The late Benjamin Lee Whorf's brilliant analysis of the Hopi language forms a valuable addition to the volume.

M. F. ASHLEY MONTAGU

Department of Anthropology, Rutgers University

Dirichlet's Principle, Conformal Mapping, and Minimal Surfaces. R. Courant. New York: Interscience, 1950. 330 pp. \$4.50.

This is a brilliant exposition of the sphere of mathematics centered around Dirichlet's principle for surfaces, and it brings together many of the important developments in the theory since H. Weyl's classical work *Die Idee der Riemannschen Fläche*. Weyl's book marked the end of the period, beginning with Lord Kelvin in 1847, during which Dirichlet's principle was vigorously established for Riemann surfaces. Subsequent developments, strongly influenced by Weyl's treatment, have been in two directions: (a) generalization of the theory to higher manifolds by E. Cartan, Hodge, De Rham, Bochner, Weyl, and others; (b) generalization of Dirichlet's principle to the theory of minimal surfaces by Douglas, Rado, Courant, Morse, Shiffman, and others and its application to problems in the general theory of conformal mapping of surfaces.

The book, although concerned with developments of type (b), provides an excellent perspective for the understanding of other developments of a more abstract nature. As the author states in the preface, "It is written in a style which . . . expresses adequately the balance and tension between the individuality of mathematical objects and the generality of mathematical methods."

An appendix by M. Schiffer summarizes some recent developments in the theory of conformal mapping, with emphasis on the kernel function and variational methods.

The rich content of the book cannot be indicated by listing the various topics discussed.

D. C. SPENCER

Department of Mathematics
Princeton University

Scientific Russian: A Textbook for Classes and Self-Study. James W. Perry. New York: Interscience, 1950. 846 pp. \$7.50.

Modern languages contain within themselves subdivisions of the forms of expression generally used by scientific workers in their publications. Whether one agrees to the need for such subdivision, on the grounds of linguistic practices, the fact itself exists, and its existence is being continually perpetuated by the rather formalized mode of scientific writing. In most cases one is on fairly easy ground in comprehending a foreign language publication dealing with a scientific subject; relatively easy ground, that is, in comparison with the truly literary expression of the general literature, prose or fiction. The relative ease of the technical literature shows up exceptionally well in the Russian language, as Dr. Perry points out. Several years of close study would be needed by a

moderately serious student who tries to tackle the general Russian literature, with its many varied forms of expression, shaded meanings, idioms, and plain "slang." On the other hand, a period of a year should suffice for a fairly sound adaptation to scientific Russian.

Here is a welcome and sound addition to the available textbooks dealing with the Russian language. Points of grammar are well illustrated with numerous examples, and a liberal sprinkling of tables of the usual word forms is provided, along with a vocabulary of nominal size. The author points out that the truly phonetic nature of the language is frequently modified in actual speech and that the student cannot expect to "sound" like a Russian, unless a Russian-speaking colleague aids him in the process. However, the reviewer feels that Dr. Perry has done an excellent job of providing numerous pronunciation aids, of which the indication of accent placing is probably the most important.

The logical order of presentation used in the book must be commended, particularly the early stress on reading aloud; the usefulness of this device cannot be overemphasized in studying the Russian language.

In physical appearance the book is attractive, and the "open" appearance of the pages, with room for marginal notes, is welcome to many "scribblers" among us. The price is rather high, although not out of line with the current trend—particularly when the thoroughness of treatment is considered.

It is a minor fault of the book that the "dropped" letters of the prerevolutionary Russian are mentioned only briefly in the beginning. Many of the classical scientific works in Russian belong to the early days, and a student might encounter a bit of trouble in reading such material, after seeing only the examples of modern Russian in the book provided by Dr. Perry.

G. M. KOSOLAPOFF

Department of Chemistry
Alabama Polytechnic Institute

Scientific Book Register

The Principles of Cloud-Chamber Technique. J. G. Wilson. New York: Cambridge Univ. Press, 1951. 131 pp. \$2.75.

Photometric Atlas of the Near Infra-Red Solar Spectrum, 18465 to 125,242. Orren C. Mohler et al. Ann Arbor, Mich.: Univ. Michigan Press, 1950. 124 pp. \$4.00.

Races & Cultures of India. Rev. ed. D. N. Majumdar. Lucknow, India: Universal Publishers, 1950. 215 pp. Rs. 8/8.

Quantum Mechanics. Alfred Landé. New York: Pitman, 1951. 307 pp. \$5.50.

The Practice of Sanitation. Edward S. Hopkins and Francis B. Elder. Baltimore, Md.: Williams & Wilkins, 1951. 423 pp. \$7.50.

Geography in the Twentieth Century. Griffith Taylor, Ed. New York: Philosophical Library; London: Methuen. 630 pp. \$8.75.

Natural and Synthetic High Polymers. 2nd ed. Kurt H. Meyer. New York-London: Interscience, 1950. 891 pp. \$15.00.

Experimental Physiology. With anatomical and mechanical illustrations and an appendix of technical data. Rev. ed. Maurice B. Visscher, Ernest B. Brown, and Nathan Lifson. Minneapolis, Minn.: Burgess, 1950. 126 pp. \$2.75.

The Nomogram: Theory and Practical Construction of Computation Charts. 4th ed. H. J. Allcock and J. Reginald Jones; revised by J. G. L. Michel. New York-London: Pitman, 1950. 238 pp. \$3.75.

TV and Other Receiving Antennas. Arnold B. Bailey. New York: Rider, 1950. 595 pp. \$6.00.

L'Ozone Atmosphérique. Charles Fabry. Paris, France: Centre National de la Recherche Scientifique, 1950. 278 pp.

Radiation Monitoring in Atomic Defense. Dwight E. Gray and John H. Martens. New York: Van Nostrand, 1951. 122 pp. \$2.00.

Big Hugh: The Father of Soil Conservation. Wellington Brink. New York: Macmillan, 1951. 167 pp. \$2.75.

Metabolic Interrelations. Transactions of the Second Conference, January 9-10, 1950. Edward C. Reifstein, Jr., Ed. New York: Josiah Macy, Jr. Foundation, 1950. 279 pp. \$3.95.

Applied Nuclear Physics. 2nd ed. Ernest C. Pollard and William L. Davidson. New York: Wiley; London: Chapman & Hall, 1951. 352 pp. \$5.00.

James Lind: Founder of Nautical Medicine. Louis H. Roddis. New York: Schuman, 1950. 177 pp. \$3.00.

Advances in Carbohydrate Chemistry, Vol. 5. Claude S. Hudson and Sidney M. Cantor, Eds. New York: Academic Press, 1950. 322 pp. \$6.80.

Biological Antioxidants. Transactions of the Fourth Conference, December 8-9, 1949. Cosmo G. Mackenzie, Ed. New York: Josiah Macy, Jr. Foundation, 1950. 181 pp. \$3.25.

The World of Science. 2nd ed. F. Sherwood Taylor. New York: Norton, 1950. 1,064 pp. \$7.50.

Vitamins and Hormones: Advances in Research and Applications, Vol. VIII. Robert S. Harris and Kenneth V. Thimann, Eds. New York: Academic Press, 1950. 342 pp. \$6.80.

A Laboratory Guide to the Anatomy of the Rabbit. E. Horne Craigie. Toronto, Canada: Univ. Toronto Press, 1951. 113 pp. \$2.75.

Proceedings of the International Statistical Conferences, Econometric Society, Vol. V. September 6-18, 1947, Washington, D. C. Dickson H. Leavens, Ed. Baltimore, Md.: International Statistical Conferences, care Monumental Printing Co., 1950. 340 pp.

The Smut Fungi. A Guide to the Literature, with Bibliography. George William Fischer. New York: Ronald Press, 1951. 387 pp. \$6.00.

Les Propriétés Optiques des Lames Minces Solides, XXIII. Colloque International du C.N.R.S., Marseille, 19-23 Avril 1949. Paris, France: Centre National de la Recherche Scientifique, 1950. 176 pp. 2,200 fr.

The Science of Health. 2nd ed. Florence L. Meredith. Philadelphia: Blakiston, 1951. 452 pp. \$3.75.

News and Notes

Scientists in the News

Harry W. Afflerbach has been appointed director of research at Ingram-Richardson Mfg. Co. of Indiana, Frankfort. Mr. Afflerbach succeeds **Clark Hutchison** who resigned recently.

Alfredo Barrera-Vasquez, former professor at Tulane University, has joined the Secretariat of Unesco in Paris. His principal responsibility will be a study of methods of combating illiteracy in multilanguage countries, especially those in which large portions of the population speak other than the official languages. His first task will be to prepare for a meeting of 15 educators from Asia, Latin America, and Africa to be held in November at Unesco House. Prior to going to Tulane in 1949, Dr. Barrera-Vasquez headed Mexico's institute for the teaching of literacy to monolingual Indians.

Jean S. Beeman has joined the ONR as assistant to Freeman H. Quimby, head of the Physiology Branch. She was formerly with the National Cancer Institute as a biologist. **Marguerite Young**, research psychologist, has become assistant to John T. Wilson, head of Personnel and Training, Human Resources Division. She was formerly with NRL.

Jorgen Kristian Frederick Bornvig, civil engineer with the National Testing Institute, Copenhagen, arrived in the U. S. on March 15, to study the chemical analysis of metals under the auspices of the Technical Assistance Program. Mr. Bornvig's schedule includes a study of ore and mineral analysis by spectrographic means at the Geological Survey Laboratory, and of spectrography, spectrophotometry, fire assaying, and potentiometry at the National Bureau of Standards.

James Harrington Boyd has been appointed visiting professor of chemical engineering at the Columbia University School of Engineering. Dr. Boyd, who will teach in the spring session, is a specialist in the commercialization of chemical research and its coordination with manufacturing and sales. During the war, he participated in the synthetic rubber program.

E. M. Crowther, head of the Chemistry Department, Rothamsted Experimental Station, is studying soil and fertilizer research under the auspices of ECA at the USDA Plant Industry Station, TVA, and several of the land-grant colleges.

T. Z. Csaky, of Duke University School of Medicine, has joined the staff of the University of North Carolina School of Medicine as assistant professor of pharmacology.

Maurice Ewing, professor of geology at Columbia and specialist in the investigation of the bottom of the Atlantic Ocean, will deliver the 1951 Westbrook Free Lecture of the Wagner Free Institute of Science,

Philadelphia, on "Exploration of the Atlantic Ocean Basin." The lectureship was founded in 1912 under the terms of the will of Richard B. Westbrook.

The secretary-general of the South Pacific Commission, **W. D. Forsyth**, plans to relinquish his post and return to Australia. The Australian government made Mr. Forsyth's services available to the commission in 1948. His extended leave from the Australian External Affairs Service expires this year. Mr. Forsyth was counsellor at the Australian Embassy in Washington and Australian representative on the Trusteeship Council at Lake Success at the time of his appointment. **F. L. Hunt** retired on November 28 as deputy secretary-general, and **J. Ryan** of the commission staff has been appointed acting deputy secretary-general pending the selection of a permanent appointee.

James M. Hamilton has been named head of the Division of Plant Pathology, New York State Experiment Station, Geneva, by the Board of Trustees of Cornell University. Dr. Hamilton succeeds **Otto A. Reinking**, who retired in April 1950, and has been associated with the station at Geneva since 1930.

Elmer L. Henderson, surgeon, Louisville, Ky., was unanimously elected president of the new American Medical Education Foundation, which is raising funds within the medical profession for the unrestricted use of the nation's medical schools. Dr. Henderson is also president of the American Medical Association and of the World Medical Association.

Among recent visitors the Agricultural Research Administration mentions **Guiseppe Jannone**, director of Italy's Plant Disease Laboratory, and **Oivind Haugen**, professor of engineering, and head of Norway's Agricultural Engineering Institute.

H. Fraser Johnstone, head of the chemical engineering division, University of Illinois, and **Mott Souders, Jr.**, director of chemical engineering research, Shell Development Co., have been appointed to the advisory board of the chemical engineering series of text and reference books published by the McGraw-Hill Book Co. This series, originally outlined in 1925 by a committee of 12 educators and industrialists, now includes 31 titles.

William J. Kelley has been appointed a consultant on industrial relations and manpower in the Department of Defense. Father Kelley is a former chairman of the New York State Labor Relations Board and a member of the panel of arbitrators of the Federal Mediation and Conciliation Service. He is professor of social philosophy at the Oblate House, Catholic University, Washington.

Carney Landis, professor of psychology, Columbia University, and principal research psychologist, Psy-

chiatric Institute, has been appointed Walker-Ames visiting professor of psychology at the University of Washington for the spring quarter.

On sabbatical leave, **Herbert L. Mason**, professor of botany and director of the herbarium, University of California, Berkeley, is conducting some research at the University of Nebraska. During his visit he will deliver two public lectures in his specialized fields of taxonomy, paleobotany, and plant geography.

Columbia University has appointed **Philip E. Mosely**, professor of international relations, as director of its Russian Institute. He succeeds **Geroid T. Robinson**, who resigned to devote more time to teaching and research. Dr. Mosely has been on the staff of the institute since it was organized five years ago.

John G. Munson, who since 1939 has been Vice President—Raw Materials, U. S. Steel Company, has recently retired, but his services in an advisory capacity will be available. The position of Vice President—Raw Materials, has not yet been filled, but the engineering and raw materials function for the time being will be under the direction of **M. W. Reed**, an executive vice president. The discovery of the Cerro Bolivar iron ore deposits in Venezuela and the development of beneficiation methods for treating Minnesota taconite ores were outstanding achievements scored by U. S. Steel during Mr. Munson's term as vice president. He had previously served as president of Michigan Limestone and Chemical Company and Bradley Transportation Company.

John Paul Nafe, on sabbatical leave from Washington University, St. Louis, is a visiting professor of psychology at the University of Texas for the spring semester.

Recent visitors at the National Bureau of Standards were **Matsujiro Oyama**, professor of electrical engineering, University of Tokyo; **Saburo Kumagai**, professor of telecommunications, University of Osaka; **Yoshio Fujioka**, professor of physics, Tokyo University of Education; **D. Sharma**, lecturer in physics, University of Allahabad; and **Heimo Kautonen**, architect, Ministry of Works, Helsinki.

Thomas A. Perls recently joined the staff of the National Bureau of Standards in the Office of Basic Instrumentation. He is engaged in basic research on such projects as pneumatic instruments (measuring instruments based on critical flow through nozzles and orifices) and spring transducers (springs which, when pulled apart, separate progressively instead of simultaneously, thus providing means for conversion of mechanical displacement into a change in electrical resistance). Dr. Perls came to this country from Germany in 1939 and entered Yale University as a physics student. He began research at the David Taylor Model Basin in 1945, becoming head of the instrument development section in 1948.

ARA recently enjoyed a visit of a large delegation

of Turkish scientists, most of whom are connected with the Ministry of Agriculture. Among them were **Talat Vardar**, **Ali Bulat**, **Cemalettin Omurtag**, **Ahsen Adaoglu**, and **Mustafa Durusoy**.

O. H. Wansbrough-Jones, formerly scientific adviser to the Army Council, has been appointed principal director of scientific research (defense) at the British Ministry of Supply.

Frederick P. Willcox, of Washington, D. C., has been named vice president and director of research of Fairchild Camera and Instrument Corporation. For the past two years Mr. Willcox has served as consultant to the government in Washington, as well as to Fairchild, for which he has developed specialized equipment, including a series of high-speed aerial camera shutters that give exposure intervals as brief as 5/10,000 second.

Hurd C. Willett, of MIT, has received the award of the American Meteorological Society for his contributions to synoptic meteorology. The society also honored **Henry S. Shaw**, of Westport, Maine, an amateur meteorologist, and commended *House Beautiful* magazine "for the far-reaching and highly stimulating work initiated through its climate control project."

Colleges and Universities

A center of Pakistan studies is being developed at Columbia University as part of the projected Near and Middle East Institute, the first part of which was opened last fall as a center for Israeli studies. The Pakistan government has pledged an annual grant to support the studies.

The Escuela de Bellas Artes is now an official part of the new Instituto Allende, of Mexico's University of Guanajuato.

The Economic Cooperation Administration will bring 40 students from Formosa and Free China to the U. S. for a year's training in agriculture, engineering, public health, and the natural and social sciences. After their training here they will be expected to continue their work in their native countries.

During its Summer School for American Students, the University of Oslo will hold a special Institute for English-speaking Teachers (June 23-August 4). Besides a general survey of Norwegian culture, a course on the education system of Norway is planned. In honor of the Nobel peace prize winner, several Norwegian firms have donated a Ralph Bunche Scholarship Fund to the summer school. At least two of the four 1951 scholarships will probably be awarded to American Negro students. Inquiries regarding the teachers institute should be addressed to Oslo Summer School Admissions Office, St. Olaf College, Northfield, Minn.

In addition to a Conference on Science in General Education to be held at Harvard July 9-11, the

Summer School will offer "History of Modern Science, 18th to 20th Centuries" (I. Bernard Cohen); "Philosophy of Modern Science" (Philipp G. Frank); and "Field and Laboratory Work in Biology" (Albert E. Navez).

The elevation of Rhodes University College, Grahamstown, to full university status early in March brings to a total of eight the teaching universities in South Africa—four English and four Afrikaans. J. H. Viljoen, minister of education, arts, and science, Eric Louw, minister of economic affairs, and B. J. Schonland, former president of the Council for Scientific and Industrial Research, participated in the inaugural ceremonies.

A fund of \$4,800,000 has been authorized to provide new buildings for the University of Tennessee medical units. Six existing buildings will be remodeled. The expansion program will also enable the College of Medicine to admit 200 new students each year instead of 140.

The University of Wyoming will hold its regular summer field courses in zoology, geology, and botany at its Science Camp in the Medicine Bow Mountains, June 18–July 21. Laboratory space for professional workers may be procured without charge; the only charge is for board and room. Further information may be obtained from the camp director, S. H. Knight, University of Wyoming, Laramie.

Fellowships

Allied Chemical & Dye Corporation has renewed its awards of 31 graduate fellowships in 24 universities, colleges, and institutes of technology for the academic year 1951–52. Mainly in the fields of chemistry and chemical engineering, the fellowships have been offered to the University of California, Caltech, Carnegie Tech, Chicago, Columbia, Cornell, Duke, Harvard, Illinois, Iowa, McGill, MIT, University of Michigan, Minnesota, Northwestern, Ohio State, Penn State, University of Pennsylvania, Brooklyn Polytechnic, Princeton, Purdue, Syracuse, Wisconsin, and Yale.

The Oak Ridge Institute of Nuclear Studies, which is administering the Atomic Energy Commission's fellowship programs for 1951–52, has announced the personnel of the nine-man fellowship board that will select AEC-sponsored fellows: George B. Pegram, chairman; and George H. Boyd, Robert G. Brode, Detlev W. Bronk, Leland J. Haworth, Warren C. Johnson, Homer W. Smith, Elvin C. Stakman, and Douglas Whitaker. The board met in Oak Ridge March 20–21 and selected more than 200 fellows from 586 applicants. Notices were mailed on March 30.

Du Pont is making a regular gift of \$15,000 for five years to establish an annual research professorship in chemistry at Harvard in the name of Wallace Hume Carothers, inventor of nylon, who died in 1937. Each Carothers professor will be enabled to devote

his full time for one year to directing research in chemistry at the postgraduate and postdoctoral level. First Carothers professor will be E. Bright Wilson, Jr., who will continue as Theodore W. Richards professor of chemistry. His work has centered on the study of quantum mechanics in chemistry.

Meetings and Elections

The American Society of Tool Engineers elected J. J. Demuth president at its annual meeting in New York. L. B. Bellamy, Roger F. Waindle, and T. J. Donovan, Jr., were elected vice presidents; W. A. Thomas, secretary; H. C. McMillen, treasurer; and H. B. Osborn, Jr., assistant secretary-treasurer.

A conference supported through a \$2,000 gift from the Wenner-Gren Foundation will be held at Northwestern May 17–19. Limited to the 20 specialists in human behavior problems who will be members of the conference, the program will have one lecture open to the public, which will include a discussion by an anthropologist and a psychiatrist on "What We Know and What We Don't Know." Ralph Linton, Bryce Boyer, and Otto Klineberg are among those who will participate in the meeting. Francis L. K. Hsu is chairman of the committee on arrangements.

New officers of The Electrochemical Society, who will take office at the Washington meeting, are Ralph M. Hunter, president, and Marvin J. Udy, vice president. Henry B. Linford, of Columbia University, and E. G. Widell, of RCA, will continue as secretary and treasurer, respectively.

The Federation of American Societies for Experimental Biology will offer a placement service, April 28–May 3, at its Cleveland meetings in the Public Auditorium. Registration of applicants is scheduled for Saturday and Sunday, registration of employers from Sunday until Tuesday, and interviews Monday through Thursday. Advance registrations will be accepted at the Washington office, 2101 Constitution Ave., Washington 25, until April 15. Applicants already registered must notify that office by April 15 so that their records may be taken to Cleveland.

A symposium on Pacific research, sponsored by the Hawaiian Academy of Science, was held in Honolulu March 9–10. Addresses were given by L. D. Baver, who presided, Peter H. Buck for the Bernice P. Bishop Museum, K. C. Leebriek for the South Pacific Commission, Harold J. Coolidge for the NRC Pacific Science Board, and Loring G. Hudson for the Pacific Science Council Secretariat. Brief reports of research also were given by representatives of a dozen governmental and private scientific institutions present in Hawaii. About 130 scientists, grouped into 11 committees, then reviewed what scientific work had been and is now being done in the Pacific, and formulated recommendations for future work. At the final session, more than 150 recommendations were approved by the combined group. The committees covered geology, geophysics, hydrology, meteorology, oceanog-

raphy, zoology, entomology, conservation, museums in Pacific research, soil survey, land classification, crop improvement, soil management, animal improvement, anthropology, social sciences, health, and nutrition. Both papers and recommendations will be published in the *Proceedings* of the Hawaiian Academy of Science.

Miscellaneous

The Festival of Britain, May 3 through September, will celebrate Britain's contribution to civilization in science and technology, the arts, architecture, and industrial design. Science's part in the festival will consist of a number of officially organized exhibitions, of conferences and special activities arranged by the learned societies and institutions. The *South Bank Exhibition* (London) will emphasize British contributions to civilization, examples being selected chiefly from science, technology, and industrial design. A special feature will be the Dome of Discovery, where British initiative in discovery will be shown to be a continuing world force, extending not only over the earth and oceans but into the heart of the atom and outward to the extremes of the universe itself. The *Exhibition of Science* (South Kensington) has a more limited theme—present-day knowledge of the inner structure of matter, both living and inert. The displays will show what is now known of the inner structure of the atom and of the living cell, how substances are built up, and how animals and plants grow. A Stop Press section will display some of the lines on which contemporary research is proceeding. The *Exhibition of Industrial Power* (Glasgow) will be concerned with heavy engineering and shipbuilding. Its story will follow two sequences—power as originating in coal, and power as originating in water. New forms of display will present a graphic picture of contemporary development, not omitting its human implications. The festival ship *Campania* will contain a smaller version of the South Bank Exhibition. It will coast the British Isles, putting in for short periods at a number of the more important centers of population. Among the organizations arranging other scientific activities are: The Royal Society, British Association for the Advancement of Science, Department of Scientific and Industrial Research, Council for British Archaeology, Building Research Council, Chemical Society, Imperial Institute, Textile Institute, Torry Research Station, Royal Geographical Society, National Rose Society, International Society of Clinical Pathology, Royal Photographic Society, Royal Society of Medicine, and many others.

Chemicals wanted by the Registry of Rare Chemicals, 35 W. 33rd St., Chicago 16, are: iron dithionate; magnesium saccharate; aluminum methionate; strontium perchlorate; copper selenide; 2,2'-biquinoline; *p*-hydroxybenzophenone; salicylalazine; 2,4,6-trichlorobenzaldehyde; 2,3,4-trichlorobenzaldehyde; 2,3,4,6-tetrachlorobenzaldehyde; trisilane; 4-aminobutanal; 1,5-dihydroxyanthracene; 4'-methoxy-2,4-diaminoazobenzene; 1,4-diaminopentane; tribromofluoromethane; fabiatriin; scopolin; and tibatin.

Recent Deaths

Theodore J. Abbott (78), physician, Cornwall-on-Hudson, N. Y., Mar. 1; William Fitch Allen (75), anatomist, Portland, Ore., Mar. 11; Henry L. Banzhaf (85), dean emeritus, Marquette Dental School, Milwaukee, Mar. 6; Samuel L. Bauer (47), pediatrician, Cincinnati, Feb. 18; King Chu (63), educator, Hartford, Conn., Mar. 9; Lennie P. Copeland (69), mathematician, Wellesley, Mass., Jan. 11; Harry S. Crossen (82), gynecologist, St. Louis, Mar. 10.

John J. Decker, surgeon, Albany, N. Y., Feb. 23; Eginhard Dietze (59), electrical engineer, Bradenton, Fla., Feb. 25; A. Wilmer Duff (86), physicist, Worcester, Mass., Feb. 24; Edison J. Emerick (87), neurologist, Winter Park, Fla., Feb. 25; James Bruce Ferguson (83), nose and throat specialist, Toronto, Feb. 28; John Francis Gallie (37), geologist, New York City, Jan. 12; Henry Solon Graves (79), forester, Brattleboro, Vt., Mar. 7.

Thomas Harvey Haines (79), psychologist and psychiatrist, Montclair, N. J., Mar. 2; William D. Harkins (77), chemist, Chicago, Mar. 7; Harry C. Henley (61), agricultural economist, Washington, D. C., Mar. 10; J. Gardner Hopkins (68), bacteriologist, New York City, Feb. 27; Cheng-Yang Hsu (53), physicist, Hampton, Va., Feb. 17; Richard F. McCoart (60), surgeon and gynecologist, Providence, R. I., Feb. 25; Johannes Mattfeld (56), taxonomist, Berlin, Jan. 19; George A. Miller (87), mathematician, Champaign, Ill., Feb. 10; Edmund Rich Morton (54), electrical engineer, Brooklyn, N. Y., Feb. 20.

William R. Nicholson (82), gynecologist, Philadelphia, Feb. 18; Calvin Gates Page (83), bacteriologist, Boston, Feb. 25; Chang Po-ling (76), educator, Tientsin, China, Feb. 27; Harvey Lee Price (76), horticulturist, Ingomar, Pa., Feb. 18; James W. Price (74), tuberculosis specialist, Saranac Lake, N. Y., Feb. 24; George S. Reiss (57), surgeon, Long Beach, L. I., N. Y., Mar. 2; J. F. Riitt (57), mathematician, New York City, Jan. 5; Aimar H. Rollefson (49), physicist, Houston, Tex., Feb. 18.

Edward H. Schulz (78), Colonel, U. S. Engineers, Berkeley, Cal., Mar. 3; Irving J. Siskis (52), pharmacist, New Orleans, Mar. 5; Hermon L. Slobin (67), mathematician, San Diego, Cal., Feb. 22; George Milton Smith (71), surgeon, Pine Orchard, Conn., Feb. 26; Henry Louis Smith (91), physicist, Greensboro, N. C., Feb. 27; W. Wallis Smith (64), physician, Miami, Mar. 4; Fred H. Sterns (63), anthropologist, East Meadow, L. I., N. Y., Mar. 7; Oliver S. Strong (86), neurologist, Hartford, Conn., Feb. 22; Douglas A. Thom (63), child psychiatrist, Boston, Feb. 23; Gideon Timberlake (73), urologist, St. Petersburg, Fla., Mar. 1; Harry M. Weeter (63), pathologist, Louisville, Ky., Feb. 25; Ward Benjamin White (66), food chemist, Washington, D. C., Feb. 24; William H. White (58), entomologist, Washington, D. C., Mar. 14; Fred M. Zeder (64), engineer, Miami, Feb. 24.

NEW

McGraw-Hill Books

GENERAL ZOOLOGY. New 2nd edition

By TRACY I. STORER, University of California at Davis. *McGraw-Hill Publications in the Zoological Sciences*. Ready in May

A general introductory text for colleges, the second edition of this well-known book has been revised for the incorporation of recent developments. Part I consists of general animal biology, including structure, physiology, reproduction, genetics, ecology, etc. Part II covers the animal kingdom from Protozoa to man. A revised edition of the laboratory manual to accompany *General Zoology* will be available.

ASTROPHYSICS: A Topical Symposium

Edited by J. A. HYNEK, Ohio State University. *McGraw-Hill Astronomical Series*. Ready in May

A symposium of papers treating "essentially all the active fields" of astrophysics. The fifteen contributors are leaders and authorities in their respective fields. The volume commemorates the Fiftieth Anniversary of the Yerkes Observatory and reviews the progress in astrophysics during the half-century since the founding of the observatory. The book combines many of the features of a textbook, a handbook, a historical study, and a technical treatise.

ASIA'S LANDS AND PEOPLES. New 2nd edition

By GEORGE B. CRESSEY, Syracuse University. *McGraw-Hill Series in Geography*. Ready in May

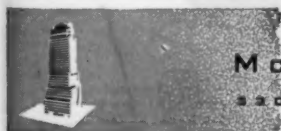
Accepted in the original edition as the first really comprehensive volume dealing with Asiatic geography from an American viewpoint, this book has been fully revised in the second edition. While the overall organization remains the same, much of the book has been rewritten in the light of the author's first-hand observation of Asia. Changes include: post-war production figures; separate chapters or rewritten material on Korea, Pakistan, Indonesia, etc.; new and improved illustrations and corrected and redrawn maps, showing new boundaries and additional material.

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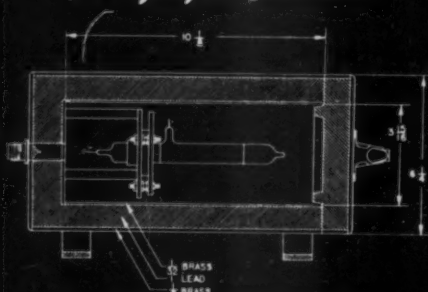
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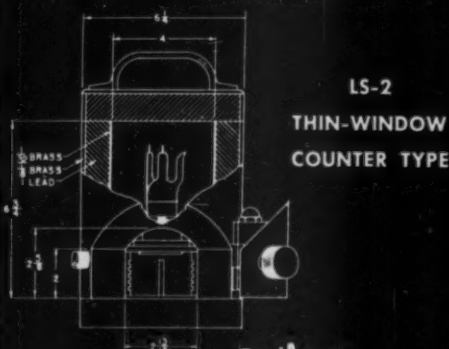
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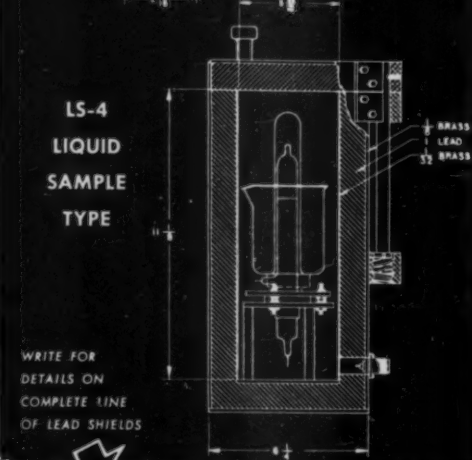


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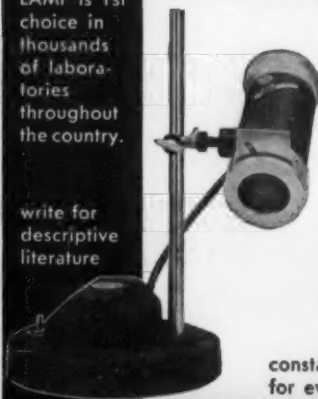
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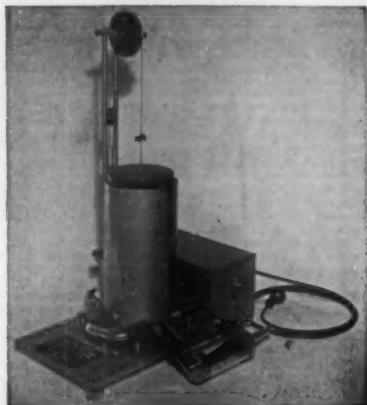
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- Apr. 14-24. Plays Schools Association (Annual). P.S. 125. New York.
- Apr. 15-18. Scientific Apparatus Makers Association (Annual). The Greenbrier, White Sulphur Springs, W. Va.
- Apr. 16-18. National Committee of the International Scientific Radio Union and Professional Group on Antennas and Wave Propagation of the Institute of Radio Engineers (Spring). Washington, D. C.
- Apr. 16-18. American Society of Lubrication Engineers (Annual). Bellevue-Stratford Hotel, Philadelphia.
- Apr. 16-18. Union Radio Scientifique Internationale. National Bureau of Standards, Washington, D. C.
- Apr. 18-20. National Petroleum Association. Hotel Cleveland, Cleveland.
- Apr. 19-21. American Philosophical Society (Annual). Philadelphia.
- Apr. 20-21. British Association of Physical Medicine. London.
- Apr. 20-21. College of American Pathologists (South Central Regional). The Shamrock, Houston, Tex.
- Apr. 20-21. Symposium on Fundamental Cancer Research of the University of Texas M. D. Anderson Hospital for Cancer Research (Annual). The Shamrock, Houston, Tex.
- Apr. 20-21. Nebraska Academy of Sciences, University of Nebraska, Lincoln.
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- Apr. 22-26. American Ceramic Society. Palmer House, Chicago.
- April 22-27. Navy Industrial Health Conference. Chalfonte-Haddon Hall, Atlantic City.
- Apr. 23-24. Industrial Accident Prevention Association (Annual). Royal York Hotel, Toronto.
- Apr. 23-25. National Academy of Sciences. Washington, D. C.
- Apr. 24-25. American Venereal Disease Association and National Institutes of Health Symposium on Advances in Luetic Control. Federal Security Building, Washington, D. C.
- Apr. 23-27. Health Congress. Southport, Eng.
- Apr. 26-28. American Physical Society, Division of High Polymer Physics. Washington, D. C.
- Apr. 27-28. National Speleological Society (Annual). Charleston, W. Va.
- Apr. 27-28. Midwestern Psychological Association. The Drake, Chicago.
- Apr. 27-28. Georgia Academy of Science, Earth Science Division. University of Georgia, Athens.
- Apr. 27-28. West Virginia Academy of Science (Annual). Marshall College, Huntington.
- Apr. 27-28. Western Psychological Association. San Jose State College, San Jose, Cal.
- Apr. 28. American Psychosomatic Society (Annual). Chalfonte-Haddon Hall, Atlantic City.
- Apr. 29-May 3. American Association for the Advancement of Science (Southwestern Division). El Paso.
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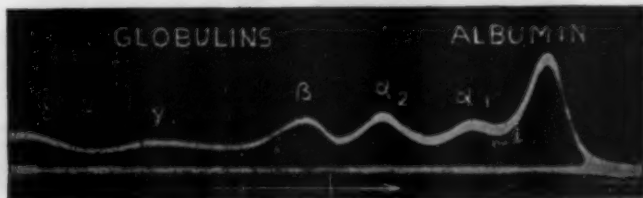
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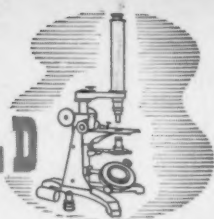
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AO Spencer Microscopes and Instruments have been designed and built in the U. S. A. for over 100 years. Hundreds of thousands are in use all over the world today, capably carrying out the purpose for which they were originally designed. Heavy wear and damage each year take their toll of these useful and valuable instruments. Proper maintenance will however extend their useful life almost indefinitely.

American Optical Company's Customer Service Department has been newly organized to give you rapid, expert, and efficient reconditioning service on AO SPENCER Instruments, optical components, and microtome knives.

AO SPENCER Branch Offices are always glad to be of help and assistance to you. Why not call the one located nearest to you for guidance in packing your instruments for shipment to the factory. Upon receipt of your instruments, quotations will gladly be furnished. Take advantage of this factory service where only factory trained workmen do the work with tools and machinery designed especially for this purpose. For further information write Dept. R1.

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